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# Foreword



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Globally, the food and agribusiness industry represents 35% of all jobs and close to 10% of GDP.<sup>1,2</sup> Food and agriculture collectively account for more than 30% of the world's greenhouse gas emissions and over 80% of tropical deforestation and biodiversity loss.<sup>3,4,5</sup> Transforming food systems is essential to meeting net-zero, nature-positive goals by 2030, providing dignified livelihoods and contributing to improved nutrition and health for the earth's 8 billion people.

It is incontrovertible that we need to transform our food systems. Now is the time to focus on the “how”. Since the first United Nations (UN) Food Systems Summit in 2021, 117 countries have committed to transform their food systems in line with the UN's Sustainable Development Goals.<sup>6</sup> While this is important progress, so far, few countries have translated those commitments into specific, integrated roadmaps. The pace and scale at which change is happening is simply not enough to meet global goals by 2030.

This report offers insights into the actions and investments that can accelerate a country's transition towards food systems that deliver a stronger economy, better livelihoods for a more inclusive set of people, greater nutritional security and improved health, while causing a lower impact on the climate and nature.

These insights are drawn from successful transformations observed over a few decades in a handful of diverse countries. They are not perfect illustrations of food systems transformation, of course. Any real-world example is going to be messy. And to cover a broad scope of different types of transformation across different countries in a relatively brief report, some details and issues are only touched on briefly or left unexplored. But these examples do offer profiles of progressive leadership in developing and emerging countries that outperformed on most — if not all — dimensions. These transformations often started as primarily agricultural productivity transformations aimed at improving food security and catalysing a broader economic transformation.

In developed markets, the picture is murkier, as no single country has outperformed on multiple key dimensions of food systems without areas of underperformance. Nevertheless, select areas of success in these markets highlight key learnings for others.

The lessons highlighted can inform actions, investments and collaboration, but peer countries should not necessarily try to follow the exact same pathway. With time running out, the scope and complexity of the challenges facing food

systems demand that plans for transformation carefully consider the inter-relations and tensions between different dimensions of these systems and concurrently apply the transformation levers most relevant for the food system at hand. These levers include government policy and related tools, public-private partnerships, technology innovation, financing, action by companies and enterprises, and multi-stakeholder coalitions.

Though they differ in detail, the country examples share common elements, which include the following:

- The important role governments play in establishing clear, long-range roadmaps and in creating a strong environment that enables inclusive, sustainable growth
- The dynamic interplay of public and private financing, and how greater coordination of such financing and other support can unlock capital flows
- The power of private enterprise to innovate and build scalable business models that can anchor more resilient food systems
- Insights into how innovations can only take hold when supported by strong ecosystems centred around farmer adoption.

This report owes much to the substantial research that already exists on food systems transformation. It was created in collaboration with the [World Economic Forum's Centre for Nature and Climate](#), whose mission is to galvanize multi-sectoral leadership to advance global insight and policy, to support collective corporate action, and to leverage innovation, finance and technology to accelerate systems transformations to meet the needs of profit, people and planet. The report also draws on Bain & Company's ongoing partnership with the Forum's [Food Action Alliance](#) and [Food Innovation Hubs](#), as well as its client work in the private, social and public sectors. We hope this report will contribute to the collective dialogue on country-led food systems transformation and motivate key stakeholders to work in coordinated ways to support farmers, consumers and the planet.

The ideas in this report will be presented to business and government leaders, beginning in 2023 at the World Economic Forum's Annual Meeting in Davos, Switzerland. These leaders can accelerate food systems transformation by collaborating through platforms such as the Food Action Alliance and CEO Alliance on Food, Nature and Health, among others. Our ambition is that this community will bring these ideas to life, helping create demonstration models of effective public-private partnership that can accelerate food systems transitions in specific countries.

# Executive summary



**When food fails, everything fails. We must work to transform our food systems to be resilient, sustainable and healthy.**

Geraldine Matchett, Co-Chief Executive Officer and Chief Financial Officer, Royal DSM, Netherlands

High-performing food systems provide healthy and nutritious diets. They create dignified livelihoods for producers and benefit the economy. They mitigate and adapt to climate change, and safeguard nature and biodiversity. Today our food systems fall far short of these goals, leading to both hunger and obesity, low resilience to external shocks, and negative impacts on climate and nature. Food systems are highly interdependent and involve a broad set of stakeholders. This report focuses on the urgent and complex transformations required at the most relevant unit of change: the country.

At a high level, the transformation pathways and levers are well known: the global community must implement climate-smart and nature-positive food and agricultural practices, change how and what we consume, innovate, focus public policy, take new approaches to financing, and collaborate across public and private sectors.

How these levers accelerate the pace and scale of change at a country level is less broadly understood. To answer that question, the report defined a set of key food systems outcomes (for which authoritative data is available across most countries) and selected seven “early mover” countries whose performance has been comparatively strong and whose examples and lessons are widely relevant. Their stories of transformation identify common, repeatable elements, including the most critical actions and investments for driving change and how they should be coordinated. Collectively, these success stories can inform faster, more holistic, country-led transitions to better food systems.

Chapter 2 looks at food systems transformations in Ethiopia, India, Vietnam and Ghana. Ethiopia’s example, which began as an agricultural transformation, illustrates how developing countries can take a systematic approach to evolving their food systems and strengthening their transformation capacity, through targeted public investment, enabling policies and institutional innovation. The transformation successes of strategic sectors in India, Vietnam and Ghana show how countries can evolve their food systems to improve a broad set of outcomes, by unlocking the potential of small and medium enterprises (SMEs), particularly those that are farmer-allied and operating in local food chains.

Chapter 3 looks at how countries are using innovation to improve outcomes in productivity, sustainability and nutrition. For example, Algeria has improved food security in the face of significant constraints on water availability, while Vietnam has sustainably intensified its rice production. Case studies from Canada and New Zealand illustrate ways to scale-up adoption of nature-positive and climate-smart food production, particularly by focusing on the case for an economic advantage for producers. The chapter draws on pockets of success in a number of countries to suggest an emerging model for shifting consumption towards healthier and more sustainable diets, by using pricing interventions from public and private actors, introducing clearer consumer communication and engagement, and increasing access to and availability of healthy and sustainable foods.

These early mover country profiles show how multiple actors coordinate and employ the varied levers available to enable large-scale change. They also show the challenges. Success has not been universal across all food system dimensions and trade-offs were made in each transformation effort. However, taken together, the profiles demonstrate the potential for these levers, when applied concurrently and with urgency, to accelerate country-led food systems transformation.

Chapter 4 presents a roadmap for multi-stakeholder actions and investments. It includes five critical, urgent and concurrent stakeholder actions, and outlines how governments, capital providers, companies, entrepreneurs and NGOs can support them.

## Roadmap for action

1. **Every country needs to develop and implement an integrated food systems transformation roadmap.** Such a roadmap needs to include mid- and long-term target outcomes across food system dimensions, detail a holistic set of public investments and policy interventions, and leverage public-private partnerships to accelerate action. Countries need to invest in building transformation capacity and leverage catalytic financing, including donor, blended and innovative financing.

2. **Prioritize high-potential, farmer-allied enterprises in transformation plans, programmes and investments.** Such enterprises operating in the middle of food value chains – particularly in developing and emerging markets – can, when scaled-up, anchor more resilient local food systems and help deliver and sustain positive outcomes across all food system dimensions. Efficient aggregator models that can enable more local sourcing and affordable nutrition also deserve more attention.
3. **Coordinate public and private financing and greater amounts of blended capital to unlock capital flows.** Countries should increase the availability of affordable debt, coordinate financial and technical de-risking mechanisms, and leverage patient, risk-tolerant capital to fuel innovation – especially innovation targeted at smallholder farmers.
4. **Scale-up change faster through technology and innovation ecosystems.** New technologies and practices can help producers improve productivity while minimizing their impacts on the climate and nature, and adapting to the changing context. Collaboration between actors must focus on creating the necessary conditions (especially economic incentives) for farmer adoption and using “multipliers” to scale-up that adoption. Multipliers may include financing, policy, technology, corporate action and pre-competitive collaboration (which further reduces investment risk).
5. **Mobilize the next generation of action-oriented, multi-stakeholder partnerships and coalitions.** These must include the right partners and ensure alignment on target outcomes, with an emphasis on building context-specific, scalable and replicable demonstration models of collaboration and mobilizing broad-based, cross-industry leadership to set standards and shift how food is produced and consumed.

Delivering on the full potential of public-private and multi-stakeholder coordination and collaboration will be key to accelerating transition towards better food systems. This will require strengthening the capacity — at individual, institutional and country levels — to understand, assess and manage the trade-offs involved in complex food systems transformations, and to navigate and build coalitions around possible change.

If countries can set clear ambitions and build integrated roadmaps for more inclusive, sustainable, healthy and resilient food systems, and if all key food system stakeholders can collectively step up and work together, it will be possible to evolve food systems in ways that nourish growing populations, build greater resilience, and enable farmers and all those engaged in these systems to live with dignity, while restoring the planet for future generations.

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# The leadership imperative: country-led transitions in food, nature and health

While challenges to subnational food systems are important and diverse, this report's fundamental premise is that countries at a national level must be the locus of transformation. They are the most relevant unit of change.



## 1.1 Food systems are no longer fit for purpose – they need transforming

Food systems are complicated combinations of interrelated and interdependent social, economic, environmental and political systems. As defined by the Food and Agriculture Organization of the United Nations (FAO), “food systems encompass the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products”.<sup>7</sup> Those products originate from agriculture, forestry and fisheries and are a critical part of their broader economic, societal and natural environments. Globally, the food and agribusiness industry represents 35% of all jobs and close to 10% of GDP, with the world’s farmers producing enough food to feed up to 10 billion people.<sup>8, 9</sup> Yet despite this apparent success, there is a strong consensus that food systems are increasingly susceptible to shocks and less and less fit for purpose.

Food and agriculture collectively account for more than 30% of greenhouse gas (GHG) emissions and over 80% of deforestation and biodiversity loss around the world.<sup>10, 11, 12</sup> An estimated one-third of all food is wasted, yet up to 2.3 billion people face moderate or severe food insecurity, a figure exacerbated by recent crises.<sup>13, 14, 15</sup> At the same time, more than one billion people are obese and diet-related diseases are the leading risk factor for death in most countries in the world.<sup>16, 17</sup> Two-thirds of working adults living in poverty rely on agriculture for their livelihoods.<sup>18</sup>

Despite their challenges, food systems, when transformed, can help solve some of the world’s toughest problems, from climate change to resilient livelihoods. Food systems encompass a wide range of food types across land and ocean, and it is possible to evolve these systems to provide food and nutrition security to our growing global population, expected to be almost 10 billion by 2050.<sup>19</sup> Advances such as regenerative farming have the potential to sequester within soils a significant share of global GHG emissions – between 9% and 23% according to a 2017 FAO estimate. Transformed food systems could help build resilient communities and create opportunities to improve lives and livelihoods, including for women, youth and Indigenous peoples.<sup>20</sup>

With fewer than eight annual planting cycles left to build more sustainable, inclusive and healthy food systems by 2030 – in line with the targets in the Paris Agreement and the UN’s Sustainable Development Goals (SDGs) – a growing number of countries are heeding the leadership imperative to act now. Since the first UN Food Systems Summit in 2021, 117 countries have committed to transform their food systems to meet the UN’s SDGs.<sup>21</sup>

Transforming global food and land use systems will require \$300-350 billion of investment per year until 2030.<sup>22</sup> This report aims to highlight where and how to prioritize those investments by answering three key questions:

1. Which common set of key outcomes should countries focus on to effectively set goals, measure progress and prioritize action?
2. How can levers — both actions and investments — work together to unlock faster progress towards target outcomes for different types of countries?
3. How can multi-stakeholder partnerships collaborate, innovate and scale-up to make maximum progress on their shared goals with the biggest returns on investment?

In exploring these questions, the report deploys a deliberately data-driven approach, by:

- Compiling a two-decade data set on the performance of 150 countries against a set of metrics that, taken together, provide for a relatively comprehensive range of food system outcomes
- Identifying early mover countries that have demonstrated consistently strong – often exceptional – performance on the key outcomes most relevant to their country’s specific context
- Analysing these national food system success stories to identify the key levers that had the greatest impacts on transformation and then to build three repeatable models based on a combination of those levers working in alignment (see Figures 6, 11 and 14)

It is worth noting that many of the transformation success stories profiled in this report have been decades in the making. Most were not launched as holistic food systems transformations, but were instead focused on the specific dimensions viewed as the most pressing challenges at the time. Several began before the impacts of climate change were broadly recognized or keenly felt. This history does not make them any less relevant as examples of countries achieving large-scale change towards better food systems. But the greater urgency and complexity of today’s food system challenges require greater resourcefulness and ambition. Whereas countries may have once activated change levers consecutively – such as government policy, public-private partnerships, financing, innovation, corporate action and multi-stakeholder coalitions – they must now deploy these strategies *concurrently*. And while the early mover examples profiled by the report are country-specific, they should be viewed as an integrated set of insights and models that are relevant to any country.

“ Food and agriculture collectively account for more than 30% of greenhouse gas (GHG) emissions and over 80% of deforestation and biodiversity loss around the world.

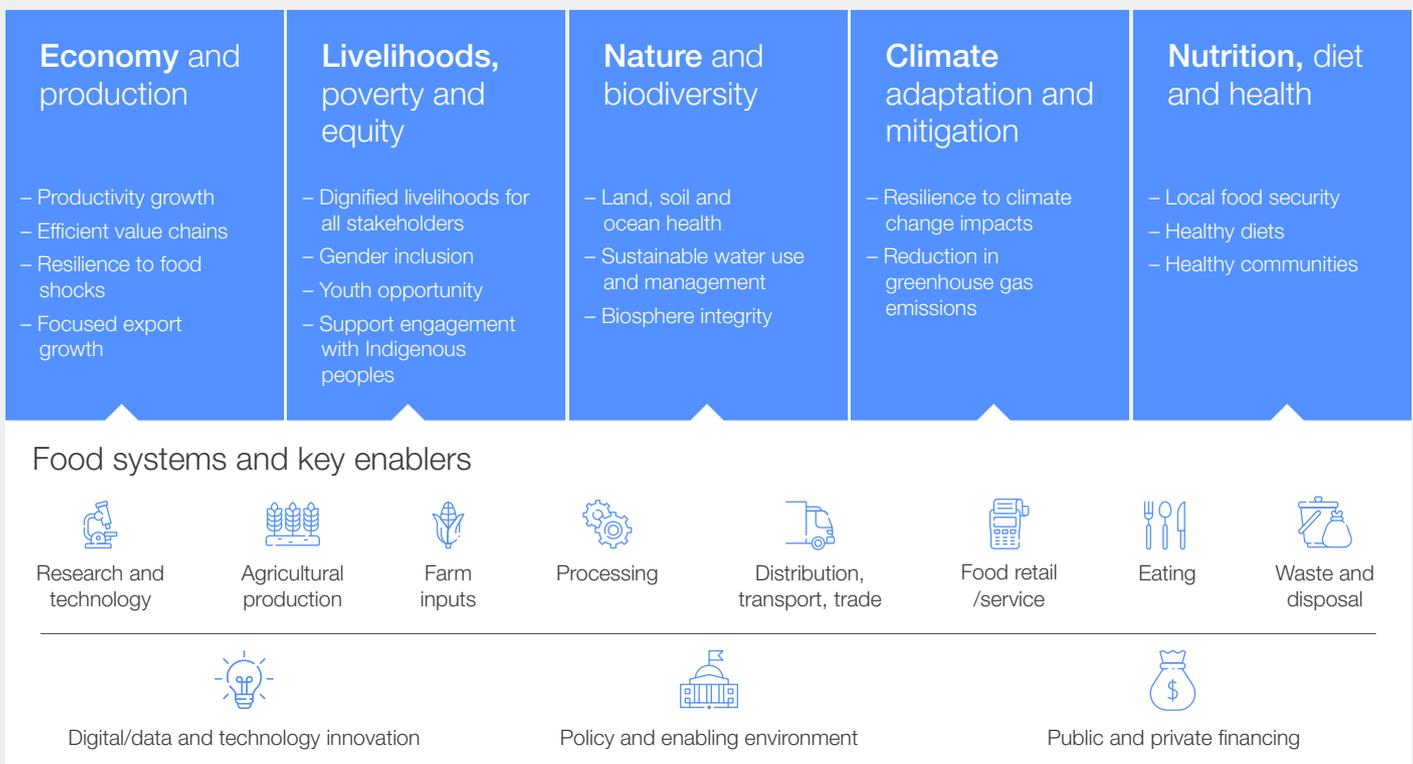
## 1.2 What defines good food systems?

Successful food systems can look different in different countries and even within countries – but they all lead to positive economic, environmental, nutrition and health outcomes. Establishing a universal definition of successful food system outcomes will help countries set the right targets, prioritize their actions and measure progress towards true food systems transformation. Although there is no single, accepted definition today, there is a significant effort underway to develop a common set of metrics to serve that purpose, known as the [Food Systems Countdown Initiative](#).<sup>23</sup> Until that standard is published, this report offers a definition

of food system success centred on five key dimensions (see Figure 1):

1. **Economy** and production
2. **Livelihoods**, poverty and equity
3. **Nature** and biodiversity
4. **Climate** adaptation and mitigation
5. **Nutrition**, diet and health

FIGURE 1 Five dimensions of food system success



Sources: World Economic Forum, Bain & Company.

This approach, grounded in data, allows objective comparisons of country outcomes. The metrics for measuring progress against each of the five dimensions of food system success are presented in Figure 2 (see row entitled “Current metrics”). These were selected from a wide range of available metrics and data points across countries, because they best meet the following five criteria:

- Important metrics by themselves (i.e. not just drivers of other outcomes)
- Non-redundant

- Widely accepted
- Available from authoritative sources
- Consistently measured and reported across countries and over time

There are additional worthwhile metrics that can be added to this dataset, once they are tracked more widely across countries and more systematically over long time periods (see Figure 2 – row entitled “Recommended metrics for future use once available”).

FIGURE 2 | Illustrative metrics to track five dimensions of food system success

← Current metrics	Recommended metrics for future use once available →
<p><b>Economy and production</b></p> <ul style="list-style-type: none"> <li>– Food production per capita**†</li> <li>– Value addition in food manufacturing, per capita*</li> <li>– Vegetable loss, post-harvest and pre-consumer*</li> <li>– Affordability of a healthy diet**†</li> <li>– Food supply adequacy†</li> <li>– Cereal import dependency ratio**†</li> </ul>	<ul style="list-style-type: none"> <li>– Pre-and post-harvest food loss**†</li> <li>– Food waste**†</li> <li>– Cost of nutrient adequacy**†</li> </ul> <hr/> <p><b>Extend to include change over time:</b></p> <ul style="list-style-type: none"> <li>– Value addition in food manufacturing, per capita†</li> </ul>
<p><b>Livelihoods, poverty and equity</b></p> <ul style="list-style-type: none"> <li>– Poverty headcount ratio at \$5.50 per day, 2011 purchasing power parity*</li> <li>– Youth employment in agriculture*</li> </ul>	<ul style="list-style-type: none"> <li>– Percentage of rural population below the country’s living income threshold**†</li> <li>– Female employment in the food sector**†</li> <li>– Youth employment in the food sector**†</li> </ul>
<p><b>Nature and biodiversity</b></p> <ul style="list-style-type: none"> <li>– Forest area†</li> <li>– Share of land degradation*</li> <li>– Eutrophication from diet, per capita*</li> <li>– Agricultural water-use efficiency**†</li> <li>– Ocean Health Index – food provision score*</li> <li>– Ocean Health Index – biodiversity score*</li> </ul>	<ul style="list-style-type: none"> <li>– Share of cropland under various nature-positive practices**†</li> <li>– Health of fish stocks (e.g. % at healthy level)**†</li> </ul> <hr/> <p><b>Extend to include change over time:</b></p> <ul style="list-style-type: none"> <li>– Share of land degraded†</li> <li>– Eutrophication from diet, per capita†</li> <li>– Share of other natural land types (e.g. wetlands, peatlands)†</li> </ul>
<p><b>Climate adaptation and mitigation</b></p> <ul style="list-style-type: none"> <li>– Farm gate GHG emissions per unit of production, crops**†</li> <li>– Farm gate GHG emissions per unit of production, livestock**†</li> <li>– GHG emissions from consumption, per capita*</li> </ul>	<ul style="list-style-type: none"> <li>– GHG emissions per unit of production, blue foods**†</li> <li>– Pre- and post-production GHG emissions (for crops, livestock and blue foods)**†</li> <li>– Resilience to climate change (e.g. damage and loss metric from FAO)**†</li> </ul> <hr/> <p><b>Extend to include change over time:</b></p> <ul style="list-style-type: none"> <li>– GHG emissions from consumption, per capita†</li> </ul>
<p><b>Nutrition, diet and health</b></p> <ul style="list-style-type: none"> <li>– Moderate to severe food insecurity**†</li> <li>– Prevalence of undernourishment**†</li> <li>– Adult obesity rate**†</li> <li>– Stunting rate for children under-5**†</li> <li>– Prevalence of diabetes**†</li> </ul>	<ul style="list-style-type: none"> <li>– Healthy diets**†</li> <li>– Prevalence of non-communicable diseases attributable to diet**†</li> </ul>

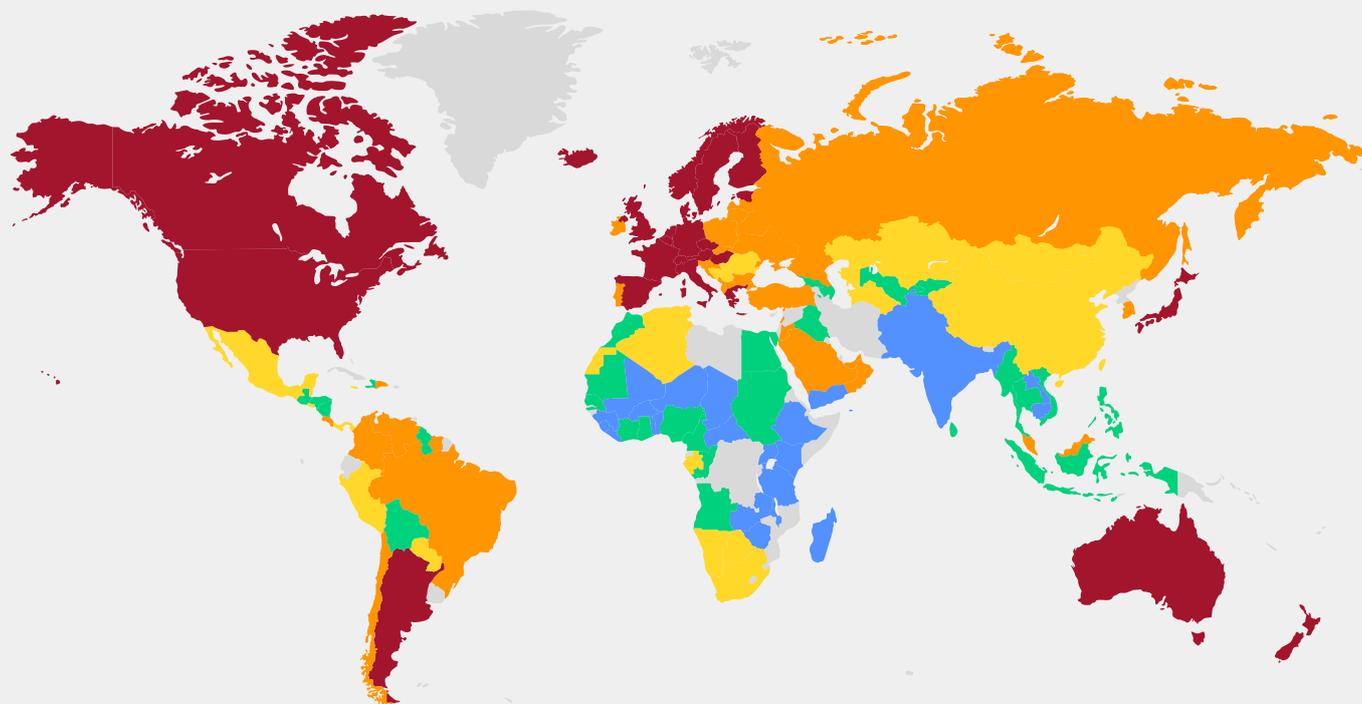
**Notes:** \* indicates data for a point in time, † indicates data measuring a change over time. Cost of nutrient adequacy is defined as the “minimum cost of using locally-available foods to obtain enough of all essential nutrients needed for an active and healthy life” by Herforth et al.<sup>24</sup> Healthy diets includes e.g. diet quality indicators, such as the Healthy Diet Indicator or Global Dietary Recommendations Score from World Health Organization (WHO).

**Sources:** World Economic Forum, Bain & Company.

To compare countries and identify meaningful trends, this report has classified countries into five types of food systems, as developed by the Global Alliance for Improved Nutrition (GAIN) and

Johns Hopkins University in their Food Systems Dashboard (see Figure 3).<sup>25</sup> Critically, these five types do not correspond to stages in a linear progression for food systems.

FIGURE 3 Food Systems Dashboard's five country classifications



### Types

### Characteristics

	<b>Rural and Traditional</b>	<ul style="list-style-type: none"> <li>– Smallholder farms, low yields of staple crops</li> <li>– Short supply chains and fragmented, informal markets; supermarkets are rare</li> <li>– Rapid growth in rural non-farm employment</li> </ul>
	<b>Informal and Expanding</b>	<ul style="list-style-type: none"> <li>– Higher productivity due to use of inputs (seeds and fertilizer) with some medium- and large-scale farms</li> <li>– Modern supply chains emerging; supermarkets expanding but informal markets still dominate</li> </ul>
	<b>Emerging and Diversifying</b>	<ul style="list-style-type: none"> <li>– Increased number of medium- and large-scale commercial farms with many small-scale farms</li> <li>– Processed foods are common in urban areas and can be found in many rural areas</li> </ul>
	<b>Modernizing and Formalizing</b>	<ul style="list-style-type: none"> <li>– High productivity with mechanization and input-intensive practices; higher food waste and spoilage</li> <li>– National distribution chains allow for diverse food consumption of fresh and processed foods</li> </ul>
	<b>Industrialized and Consolidated</b>	<ul style="list-style-type: none"> <li>– Small number of large, input-intensive farms with high market consolidation and long supply chains</li> <li>– High supermarket density and luxury options</li> </ul>

Source: [Food Systems Dashboard](#), Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University, 2020.

“Common to all countries is the need to pursue transformation levers concurrently to accelerate the transition to better food systems.

Data on a critical subset of key outcome metrics across the five dimensions of food system success – economy, livelihoods, nature, climate and nutrition – shows clear differences in performance between different country types. Insights from this short list of outcome metrics are summarized below and shown in Figure 4, using data from 2019 (or, when not available, the most recent year prior to 2019).

- Historically, food systems development has started with productivity gains. Those gains lead to improvement in economic outcomes (e.g. declining rates of poverty) and nutrition outcomes (e.g. reduced malnourishment). Although this type of development reduced emissions intensity, today a more integrated food systems approach must be taken from the outset, to avoid encountering challenges now seen in developed markets such as eutrophication, higher total emissions and obesity (see next page).
- As food systems develop further, they often focus on adding more value by processing raw agricultural output into higher margin products, (e.g. converting milk into dairy products, or

maize into flour and porridge). Value-added growth sustains and accelerates improvements in related food system outcomes, such as productivity gains, better livelihoods and reduced undernourishment.

- With more developed food systems, new issues emerge, including more extensive eutrophication of soils from fertilizer use, higher total GHG emissions from increases in crop production due to greater fertilizer and on-farm energy use, a shift towards more GHG-intensive diets that are rich in meat and processed foods, and a shift from hunger to obesity.
- Every country, of whatever type, struggles to balance competing priorities. They may need to reduce malnourishment and obesity simultaneously, or grow production for nutrition security while at the same time reducing use of natural resources. The most developed food systems have pressing challenges relating to health, climate and nature. However, common to all countries is the need to pursue transformation levers concurrently to accelerate the transition to better food systems.



FIGURE 4 | Current outcomes against the five dimensions of success, by food system type



Sources: FAO, UN Industrial Development Organization (UNIDO), World Bank, World Wide Fund for Nature (WWF), Euromonitor.

Note: Markers represent the median among countries in each of the five food system types (on x-axis) for which data is available.<sup>26</sup>

These patterns illustrate how the challenges and priorities of food systems transformation evolve as countries develop and industrialize. The data also highlights that a country's performance on one dimension affects its performance on others.

By pursuing key transformation levers in tandem, these inter-relations can be leveraged and trade-offs minimized, accelerating progress towards more sustainable, inclusive and healthy food systems.

2

## Catalysing food systems transformation

Developing and emerging countries can catalyse broader food systems transformation by investing in their transformation capacity and unlocking farmer potential and enterprise growth throughout the value chain.



## 2.1 Early movers transform traditional and informal agriculture sectors

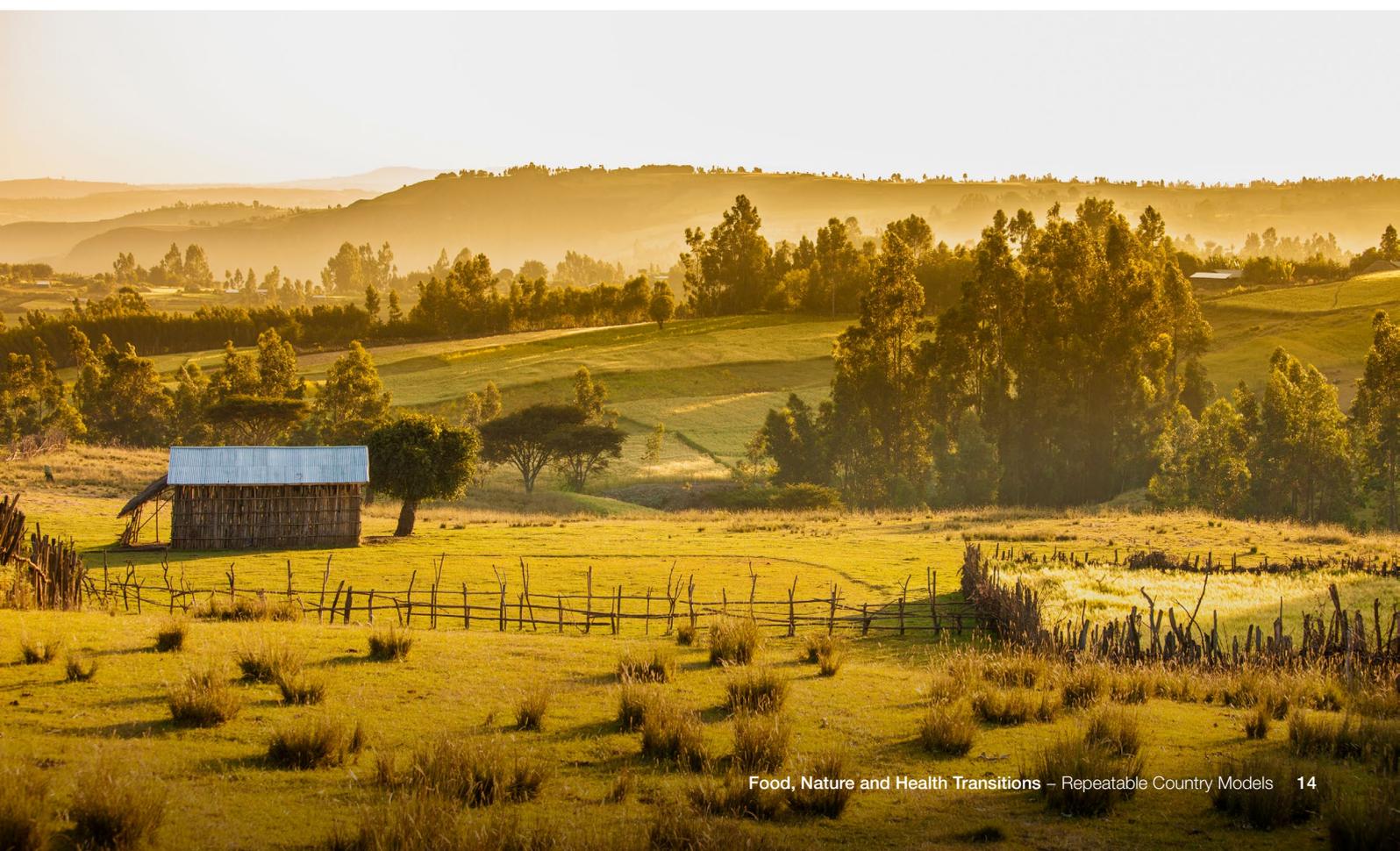
Food systems in countries classified as Rural and Traditional or Informal and Expanding (see Figures 3 and 4) are dominated by smallholder farms, typically no larger than two hectares. They are characterized by relatively low productivity and, consequently, see higher levels of poverty and food insecurity. The median productivity in Rural and Traditional countries is 40% of what is observed in the most developed markets, with roughly 90% of the population living on less than \$5.50 a day. Therefore, their food systems transformation is first and foremost an economic one and it must start with the sustainable intensification of agriculture, done in a way that minimizes land-use change and environmental degradation. Increasing farm output and productivity this way can lead to greater food security at reduced emissions intensity. When paired with fair farm gate prices, it can not only improve farmer livelihoods but also serve as a stepping-stone to broader rural transformation.

With greater commercialization and marketable surpluses, output markets develop and the economic value associated with activities beyond the farm gate increases. Private enterprises become an important force for the economic development and transformation of a country, further improving farmer livelihoods and creating jobs while providing more affordable nutrition for the local population. While what starts out as

agricultural development can come to benefit multiple food system dimensions, an emphasis on scaling-up, as later country profiles will show, can come at the expense of climate and nature outcomes. It is therefore important for countries to consider all outcomes early on in integrated transformation plans in order to avoid such unintended negative consequences that can also include a rapid uptake in ultra-processed foods and significant growth in unhealthy diets.

Productivity improvement and expansion of value addition can take place in parallel and are often mutually reinforcing. The early mover profiles below spotlight the successes of selected countries in catalysing food systems transformation starting with remarkable growth in production and productivity. These profiles are followed by three country examples of value addition transformation, all of which follow a similar repeatable model. Each profile includes a summary of the country's performance on key outcome metrics, with comparisons against countries of the same food system type (unless otherwise noted), based on the Food Systems Dashboard. These summaries generally show over-performance on many – but not all – outcome metrics, indicating areas of trade-offs or lack of focus. It should also be noted that these metrics will reflect the effectiveness of actions and investments in food systems but may not always be fully accounted for by them.

“ What starts out as agricultural development can come to benefit multiple food system dimensions.



## 2.2 Ethiopia: strengthening country transformation capacity

Twenty years ago, Ethiopia began a remarkable transformation of its agricultural sector. Between 2002 and 2018, food production per capita grew 63% compared to the median of 12% among its peer countries in the Rural and Traditional category.<sup>27, 28</sup> The yield of cereals such as teff, maize

and wheat grew by 102%,<sup>29</sup> bringing meaningful declines in undernourishment and the percentage of people living in poverty.<sup>30, 31</sup> This agricultural transformation has been an important contributor to Ethiopia's 7% annual GDP per capita growth during this period, well above the 3% of its peers.<sup>32</sup>

FIGURE 5 Ethiopia – numbers at a glance



Sources: FAO,<sup>33</sup> World Bank,<sup>34</sup> WWF,<sup>35</sup> UN Statistics Division.<sup>36</sup>

**Notes:** Food production per capita growth is from 2002-2018, using trailing 3-year average. Poverty rate decline is from 1999-2016, using trailing 3-year average; poverty rate = \$3.65/day with 2017 PPPs. Water usage efficiency uses average values (\$ per m<sup>3</sup>) for agriculture from 2017-2019. Eutrophication is for 2019. Crop and livestock emissions intensity measures tonnes of CO<sub>2</sub> equivalent per tonne of production from 2002-2018. Undernourishment rate is for 2019. Government expenditure is from 2005-2019. Annual growth in agriculture, forestry and fishing GDP is from 2005-2019. CAADP stands for the Comprehensive African Agricultural Development Programme. Return on investment (ROI) on ATA initiatives is from 2013-2019.

Three critical levers disproportionately accounted for Ethiopia's success in catalysing its food systems transformation:

- Sizeable and targeted public investment to enable sustainable intensification

- A strong enabling policy environment that evolved with food systems priorities
- Investment in institutional innovation that built its capacity to transform

“ Ethiopia illustrates how government resolve and persistent investment can dramatically alter the trajectory of a country’s agricultural development and, in turn, its economic growth.

## Sizeable and targeted public investment to enable sustainable intensification

In 2003, the African Union created a set of strategies and goals for agricultural transformation, food security and prosperity called the Comprehensive Africa Agriculture Development Programme (CAADP).<sup>37</sup> Almost 20 years later, the great majority of African governments have yet to meet the CAADP goal of spending 10% of their budgets on agriculture. In 2020, only 3.2% of total government expenditure on the continent was directed towards agriculture, according to data from the UN Statistics Division.<sup>38</sup>

Ethiopia illustrates how government resolve and persistent investment can dramatically alter the trajectory of a country’s agricultural development and, in turn, its economic growth. Between 2005 and 2019, Ethiopia was one of three African countries to consistently spend more than 10% of its government budget on agriculture, averaging 12% over the period.<sup>39</sup> During that time, Ethiopia averaged over 8% growth per year in agricultural GDP, above the 6% threshold the African Union says can drive agriculture-led economic development.<sup>40, 41</sup> Had other African countries met the recommended 10% allocation of government expenditure on agriculture starting in 2008 – and subsequently realized 6% agricultural GDP growth each year – Africa could have achieved an incremental 3.3% growth in GDP from 2008-2019, raising the continent’s cumulative GDP by more than \$800 billion.<sup>42, 43, 44</sup>

In addition to the level of spending, the nature of that spending was important. Ethiopia’s government made targeted programmatic and infrastructure investments intended to improve productivity through sustainable intensification. Crucially, it supported affordable access to inputs by scaling-up local production of seeds which were broadly distributed, along with increased imported fertilizer, through farmer cooperatives and farm services centres.<sup>45, 46</sup> A national Input Voucher System facilitated the extension of credit to farmers.<sup>47</sup>

The impact of these enhanced inputs was amplified by strategic infrastructure investments, notably in soil and groundwater mapping, that enabled production and productivity to grow in a more sustainable and climate-smart way. Using soil infrared spectrometry and satellite imagery, the country’s EthioSIS initiative developed 22 soil property maps that were used to create targeted fertilizer recommendations based on the nutrient needs and soil characteristics of each region.<sup>48, 49</sup> Experts researched shallow ground water as an irrigation method to address rainfall concerns, identifying irrigatable land and efficient methods and technology.<sup>50</sup> The government also invested

in its human infrastructure, building one of the largest extension agent networks in the world (with a 1:500 ratio) to train farmers on good agricultural practices.<sup>51</sup> It launched a farmer hotline that supports 5 million registered users.<sup>52</sup>

Ethiopia’s success with its TIRR package (Teff, Improved seed, Reduced seed rate and Row planting) illustrates how combined investments in inputs and extension can lead to significant improvements in productivity. TIRR was introduced in 2011 and in just four years reached an estimated 2.2 million farmers, increasing their yields by up to 70%.<sup>53</sup>

## A strong enabling environment that evolved with food systems priorities

In Ethiopia, successive national food and agriculture transformation programmes from 2005 onwards have established the policy framework and strategic plan required to set priorities and guide investment towards a fully integrated food systems transformation. A greater focus on agricultural commercialization and market development reinforced the economic incentives needed to encourage farmers to adopt sustainable, productivity-enhancing practices.

To grow private sector activity in agriculture, Ethiopia’s 2015 Growth and Transformation Plan II (GTPII) addressed gaps in infrastructure by expanding irrigation access, extending road coverage and increasing the skill of the labour force.<sup>54</sup> In addition, GTPII expanded special economic zones with fiscal and trade policy incentives to attract domestic and foreign investment, and to develop value chain-based partnerships with multinational corporations. From 2015-16, the government introduced the Agricultural Commercialization Clusters initiative, which focused on priority crops across the four major agricultural regions of Ethiopia. This initiative led to 32% higher productivity (measured by quintals per hectare) than the national average for these crops, achieved by providing inputs and extension services to smallholder farmers, and coordinating the efficient aggregation and transport of their produce to end markets.<sup>55, 56</sup>

Beyond multi-year roadmaps, the government has also adapted its policy and regulations to address system bottlenecks – this has proved a key success factor. For example, the government passed legislation granting duty free status to key agricultural mechanization, irrigation and feed technologies. This has helped jumpstart and expand inclusive and affordable access for smallholder farmers to these productivity-enhancing technologies.<sup>57</sup>

“ The distinctive funding model for Ethiopia’s Agricultural Transformation Agency combined external donor and government funding, giving the country the wherewithal to build its transformation capacity.

## Investment in institutional innovation that built its capacity to transform

Ethiopia’s Agricultural Transformation Agency (ATA) was established in 2010 as a nodal agency outside of the existing government bureaucracy and directly reporting to a Transformation Council chaired by the Prime Minister. Its mission was to catalyse the country’s agricultural transformation. The ATA was a technocratic organization with a strong analytics capability that informed its policy and programme design. Initially, the agency focused on conducting studies, but within a few years of its founding it had begun to launch projects such as EthioSIS, ground water mapping and a farmer hotline.<sup>58</sup> By 2018, the agency was also acting as a systems integrator for policy decisions and programme design, coordinating across ministries and sector stakeholders.<sup>59</sup>

The stable yet adaptive nature of the ATA helped it stay focused on the country’s transformation agenda over a long period of time, while evolving its capacity to address new needs and challenges. This was largely made possible by the flexible funding provided by outside donors, including The Bill and Melinda Gates Foundation, which provided the catalytic funding to establish the ATA. Over time, the ATA’s funding sources became more distributed to include several bilateral government donors – for example, the Dutch and Danish governments contributed almost half the funding, in addition to the Ethiopian government.

While funding from the Ethiopian government for the ATA peaked at 25% during the launch of the Agricultural Commercialization Clusters, on average it contributed roughly 10% of the agency’s budget during the first 10 years. This distinctive funding model that combines external donor and national government support has given the country the wherewithal to build its transformation capability.<sup>60</sup> According to an FAO evaluation of the ATA in

2020, the agency’s work contributed \$1.7 billion to Ethiopia’s GDP between 2013 and 2019 – 10 times the amount of funding deployed – and its interventions have increased private consumption by \$1.3 billion.<sup>61</sup>

## Building a fully integrated food systems strategy

Ethiopia’s food systems transformation continues today. Led by the ATA and the Ministries of Agriculture and Health, the government’s *Vision 2030: Transforming Ethiopian Food Systems* aims to address systemic challenges around nutrition, sustainable consumption, nature-positive production, equitable livelihoods and resilience to shocks.<sup>62</sup> The vision is also designed to align with other key national programmes, including the government’s 10-year development plan, *A Pathway to Prosperity*, published in 2020.

To shift consumption patterns, Ethiopia is targeting improvements in dietary diversity and nutrition literacy. Vision 2030 also highlights the contribution that agricultural interventions will make towards achieving a 64% reduction in GHG emissions by 2030 and commits to promoting agricultural technologies and innovation that increase productivity and reduce post-harvest loss. The country is also increasing its investment in data, with the Ministry of Innovation and Technology building the first nationally hosted cloud facility to store data related to health and agriculture, among other sectors.

Critically, in a move underpinned by the Agricultural Commercialization Clusters initiative, Ethiopia has committed to further strengthen markets and market access, while actively engaging the private sector as a key partner in its transformation, similar to successful private sector engagements highlighted in the following chapter.

### BOX 1

#### Ethiopia – key takeaways

- Ethiopia’s government catalysed the country’s food systems transformation and agriculture-led economic growth by consistently allocating a high share of government spending towards agriculture (>10% as per CAADP recommendations).
- Targeted government investments in enhanced inputs were amplified by infrastructure investments (notably in soil mapping and extension) that enabled production and productivity to grow in a more sustainable and climate-smart way.
- Investment in institutional innovation by donors and the Ethiopian government, in the form of the Ethiopian Agricultural Transformation Agency (ATA), helped build the transformation capability required to support policy design, programme implementation, and the integration of solutions across sectors and ministries.
- The government’s *Vision 2030: Transforming Ethiopian Food Systems* lays the groundwork for a more integrated food systems transformation roadmap covering broader outcomes on nutrition, nature-positive production, equitable livelihoods and resilience. As part of the vision, the government commits to investing in data and innovation, as well as strengthening markets and private sector engagement, underpinned by the Agricultural Commercialization Clusters launched in 2015-16.



## 2.3 Unleashing the power of the “hidden middle”: India, Vietnam and Ghana

“ In emerging markets, small- and medium-sized enterprises (SMEs) play a critical role in the midstream of the value chain – an area termed the “hidden middle” as it is often excluded from mainstream policy and investment programmes.

The development of well-functioning output markets, and by implication the expansion of the midstream and downstream of food value chains, is essential to sustaining and accelerating farmer productivity and livelihood improvement. It is also key to creating jobs and meeting the greater demand for food that comes with a growing population, urbanization and rising incomes. In developing and emerging markets, small- and medium-sized enterprises (SMEs) play a critical role in this value-addition transformation. In Africa, SMEs account for 80% of the enterprises in the midstream of the value chain – an area that the Alliance for a Green Revolution in Africa (AGRA) has termed the “hidden middle” as it is often excluded from mainstream policy and investment programmes.<sup>63</sup>

In early mover countries, government action and financing have increasingly focused on unlocking private sector investment in developing small- and medium-sized enterprises (SMEs), in particular midstream businesses including aggregators and logistics players, processors and vertically integrated brands. The most successful SMEs have become anchors of more resilient and profitable value chains by achieving meaningful scale and building inclusive sourcing models that improve the livelihoods and enhance the capacity of their smallholder farmer suppliers. With enough of these well-functioning “farmer-allied intermediaries”, as they are termed in a 2020 Bain & Company report, a country has far greater potential to deliver and sustain better outcomes across multiple food system dimensions.<sup>64</sup>

The food system success stories profiled next illustrate how the transformation of strategic commodity sectors has contributed to each country’s economic growth and led to improvements in livelihoods and nutrition. In India, for example, a multi-decade programme grounded in support for smallholder farmers and dairy enterprises has helped transform dairy into

India’s largest agricultural commodity, accounting for roughly one-third of rural incomes and 10% of total caloric intake in 2019.<sup>65, 66</sup> This transformation began with public programmes supporting the formation of village-level cooperatives, extension services and credit. In time it evolved to cultivate a domestic industry that has a number of successful, tech-enabled, vertically integrated enterprises with farmer-allied sourcing models. Sector transformations in Vietnam and Ghana have followed much the same path.

Each country’s transformation includes four repeatable elements that can be referenced by other developing and emerging countries (see Figure 6):

- Strategic sector focus
- Enabling policy and regulatory environment
- Mutually reinforcing public and private investments
- Enterprise growth and innovation

While these repeatable elements are commonly observed in food systems transformation successes in developing and emerging countries, the way these elements play out and interact differs based on the country’s specific political, economic, social and environmental contexts. Importantly, rather than playing out sequentially, these elements more often interact in dynamic and mutually reinforcing ways that accelerate the pace and scale of change.

By building an integrated approach to food systems transformation into wider economic strategy, countries can support a healthy and sustainable development pathway that avoids the significant societal and environmental costs that can come with the industrialization of the food system.

FIGURE 6 | Repeatable model #1: Success factors in commodity sector transformations

**4**  
repeatable success factors in commodity sector transformations in developing and emerging economies

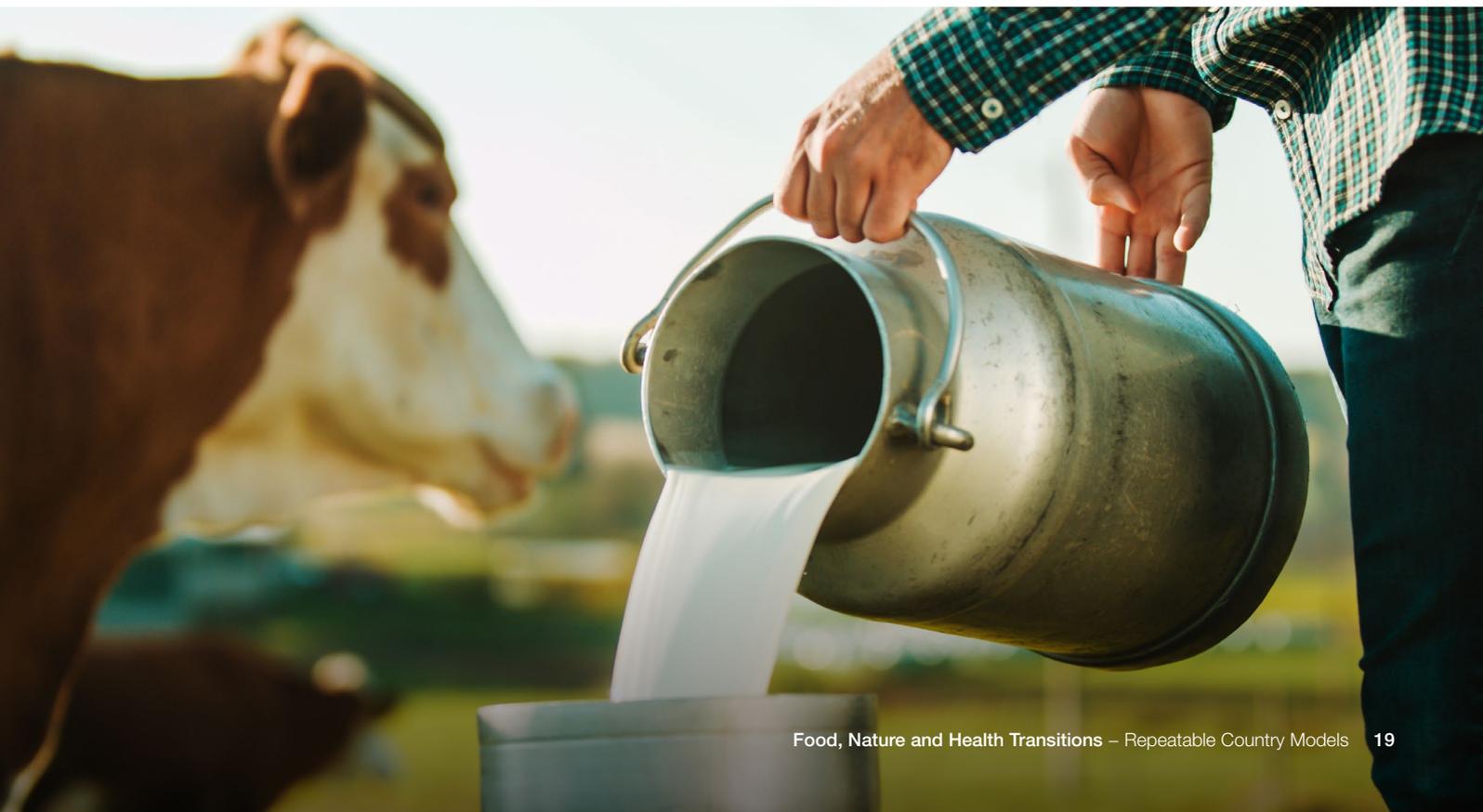
Note: \*Recommended but not yet commonly observed in early mover profiles



**Early mover profile: India**

In India, dairy is the single largest agricultural commodity, accounting for 5% of GDP and an important foundation of nutrition.<sup>67, 68</sup> India is now the world’s largest milk producer<sup>69</sup> and 70% of its milk is

produced by its 80 million smallholder farmers with herds of fewer than 10 animals.<sup>70</sup> As the country continues to urbanize, city dwellers are spending more on dairy and consuming more processed dairy products that carry higher margins.<sup>71</sup> Between 2002 and 2021, the sector’s value addition doubled, registering nearly \$15 billion in 2020.<sup>72</sup>





Sources: FAO,<sup>73</sup> World Bank,<sup>74</sup> Invest India,<sup>75</sup> NASSCOM,<sup>76</sup> IHS Markit.<sup>77</sup>

Notes: Food production per capita growth is from 2002-2018, using trailing 3-year average. Value addition in \$ millions (2015) is from 2002-2021. Water usage efficiency uses average values (\$ per m<sup>3</sup>) for agriculture from 2017-2019. Livestock emissions intensity measures tonnes of CO<sub>2</sub>-equivalent per tonne of production from 2002-2018. Undernourishment rate is for 2019. 15% of world's agritech startups is for 2019. Agritech funding growth is from 2018-2021.

“Dairy has benefitted from Priority Sector Lending put in place by the government in 1985, which requires commercial banks to lend at least 18% of their adjusted net bank credit (ANBC) to agriculture.”

The development of India's dairy sector has been more than four decades in the making. Between 1970 and 1996, the government systematically developed the dairy industry through a programme called Operation Flood. It began by linking supply to key markets, then focused on organizing farmers, setting up and extending credit to farmer cooperatives, and growing the milkshed network.<sup>78</sup> In the mid-1980s, the government began the next phase, focused on expanding facilities, strengthening infrastructure and providing extension services.<sup>79</sup>

With a combined investment of \$3 billion from 1970-1996 from both the Indian government and international institutions, Operation Flood helped to create \$337 billion in value through incremental milk production according to World Bank estimates.<sup>80</sup> This value does not include positive externalities beyond the value of the raw milk itself. For example, this report estimates that a 1.6 percentage point reduction in stunting from 1989 to 1997 can be attributed to the increase in milk production enabled by Operation Flood, which translates to roughly \$13 billion in incremental GDP during this time period.<sup>81</sup>

The enabling financing policy framework set by the government has been another critical support. Dairy has benefitted from Priority Sector Lending put in place by the government in 1985, which requires commercial banks to lend at least 18% of their adjusted net bank credit (ANBC) to agriculture and 40% overall to nine priority sectors.<sup>82, 83</sup> Any bank having a shortfall in lending to priority sectors pays the difference as a contribution to the Rural Infrastructure Development Fund (RIDF) or other funds as decided by the Reserve Bank.<sup>84</sup> Thirty years later, the requirement that smallholder farmers must account for 8% of ANBC was added.<sup>85</sup> Additionally, the selective use of import restrictions has protected domestic dairy prices and helped the dairy sector prosper.<sup>86</sup>

Government investment in rural electrification has been essential to increasing the efficiency and profitability of India's dairy value chain. It has reduced post-harvest loss and enabled the increased production of yogurt, ghee, cheese and other value-added, higher-margin dairy products. Through a loan from the National Bank of Agriculture and Rural Development, the government has funded roughly \$1.1 billion of

“ The government’s large-scale investment in digital infrastructure and data commons has helped attract additional private investment.

investment (Rs 8,004 crore) to strengthen local cold chains by, among other things, subsidizing loans to cooperatives that upgrade their milk chilling and processing plants and offering interest subsidies to investors in that initiative.<sup>87, 88</sup>

With private capital investment encouraged by dairy’s priority lending status, the number of dairy processing plants grew by over four times from roughly 700 in 2002 to more than 3,000 plants in 2019, of which nearly two-thirds were privately owned.<sup>89, 90</sup> The expansion of the private sector accelerated milk production from 66 million metric tons in 1995 to 191 million metric tons in 2019.<sup>91, 92</sup>

Most recently, India’s Dairy Investment Accelerator – founded in 2021 by the Department of Animal Husbandry and Dairying, which received \$1.9 billion (Rs 15,000 crore) in funding for its Animal Husbandry Infrastructure Development Fund – offers micro-, small- and medium-sized enterprises one-stop assistance across the investment cycle. The accelerator supports enterprises with evaluation, government applications and engaging state departments, as well as links to financial support, including 3% interest subsidies, extended repayment periods, loan moratoriums and credit guarantees.<sup>93, 94, 95, 96</sup>

One of the dairy industry’s biggest entrepreneurial success stories is Dodla Dairy, which sources from more than 220,000 smallholder farms.<sup>97</sup> Founded in 1995 and based in Hyderabad, Dodla generated \$290 million in revenue in 2020. It has built itself into an efficient, vertically integrated processor and marketer of a variety of quality dairy products over the past 25 years.<sup>98, 99</sup> It has raised at least \$150 million in capital, including \$50 million in equity invested by TPG’s Rise Fund. In 2021, it went public and had a market capitalization of more than \$350 million as of December 2022.<sup>100, 101, 102, 103</sup>

Dodla has also developed a farmer-allied engagement model, subsidizing farmer access to high-quality agricultural inputs, including cattle feed and services, such as veterinary support and selective breeding, as well as linking farmers in need of financing to collaborating banks. Today, farmers supplying Dodla earn more than twice the earnings of the average Indian smallholder farmer, with yields that are up to 25% higher than the national crossbred average.<sup>104</sup>

In recent years, innovative digital models have emerged in India’s dairy sector as well. Stellapps, an internet-of-things start-up working to digitize the dairy supply chain, collects data through sensors placed in milking systems, chilling equipment and even animal wearables, and sends relevant analytics and data science outcomes back to farmers over mobile devices.<sup>105</sup> Currently tracking 450,000 livestock, the company says it has the potential to increase milk yields by 20% and cut animal health costs by as much as half.<sup>106</sup>

Stellapps is one of many agritech start-ups to emerge in India over the last decade with the potential to further improve productivity, efficiency, inclusivity and sustainability in India’s food systems. While the transformation of India’s dairy sector has been decades in the making, its agritech explosion has happened relatively recently and very quickly. The Indian government’s approach to supporting the agritech sector, facilitated by its \$1.3 billion Digital India initiative, is following a similar approach.<sup>107, 108, 109</sup>

In 2016, the government launched a National Agriculture Market (e-NAM). It is designed to connect 7,000 state government-established and regulated marketing agencies and help farmers to get fair prices for their goods on a digital, unified, national agricultural commodity market.<sup>110</sup> The goal is to provide farmers with access to multiple markets, buyers and service providers, increase price transparency, enable more dynamic market pricing through bidding functionality and facilitate timely online payments.<sup>111</sup>

Today farmer cooperatives are allowed to act as aggregators on e-NAM and trade online from their collection centres, unlocking digital markets for a much larger group of farmers.<sup>112</sup> In 2014, the government began collecting data from farmers and the agricultural sector and, in 2021, initiated partnerships with mega-cap tech companies to analyse the data in order to provide tailored farmer solutions and sector improvements, such as access to credit, input quality, marketing methods, price discovery and waste reduction.<sup>113</sup>

This large-scale investment in digital infrastructure and data commons has helped attract additional private investment. Private equity and venture capital investment in the sector grew from \$91 million in 2017 to \$329 million in 2020 and helped to fund more than 450 agritech start-ups in all stages of the agricultural value chain, from inputs and services to harvesting, processing and distribution.<sup>114, 115</sup>

One of the most successful of these start-ups is DeHaat, which has raised over \$250 million from investors including Sequoia Capital and RTP Global.<sup>116, 117</sup> The company serves as an input and output marketplace, providing high-quality inputs to farmers and facilitating harvest trading and offtake procurement through digital platforms and farmer aggregation. DeHaat manages 2,000 agri-input orders per day and has procured 220,000 metric tons of product to date.<sup>118</sup> The company also leverages artificial intelligence to provide predictive agriculture insights and farming advice specific to crop, climate and region. Its innovative, farmer-allied digital aggregator platform shows early promise for how similar models, if effectively scaled-up, can anchor more resilient country food systems.

## BOX 2 | India – key takeaways

- Prioritization of the dairy sector and committed, multi-decade investments in related infrastructure, farmer capacity building and market linkages underpinned a broader country food systems transformation.
- Priority Sector Lending provided the essential policy framework to unlock commercial lending and private investment to support the growth of private dairy enterprises.
- Government investments in digital infrastructure and data commons created enabling conditions for explosive growth in agritech start-ups and inflow of private equity and venture capital investments.
- Scaled-up, farmer-allied enterprise models – from vertically integrated dairy processors to digital input and output marketplaces – contributed to a broad range of food systems outcomes, including economic growth, smallholder farmer livelihoods, food loss reduction and access to nutritious foods.



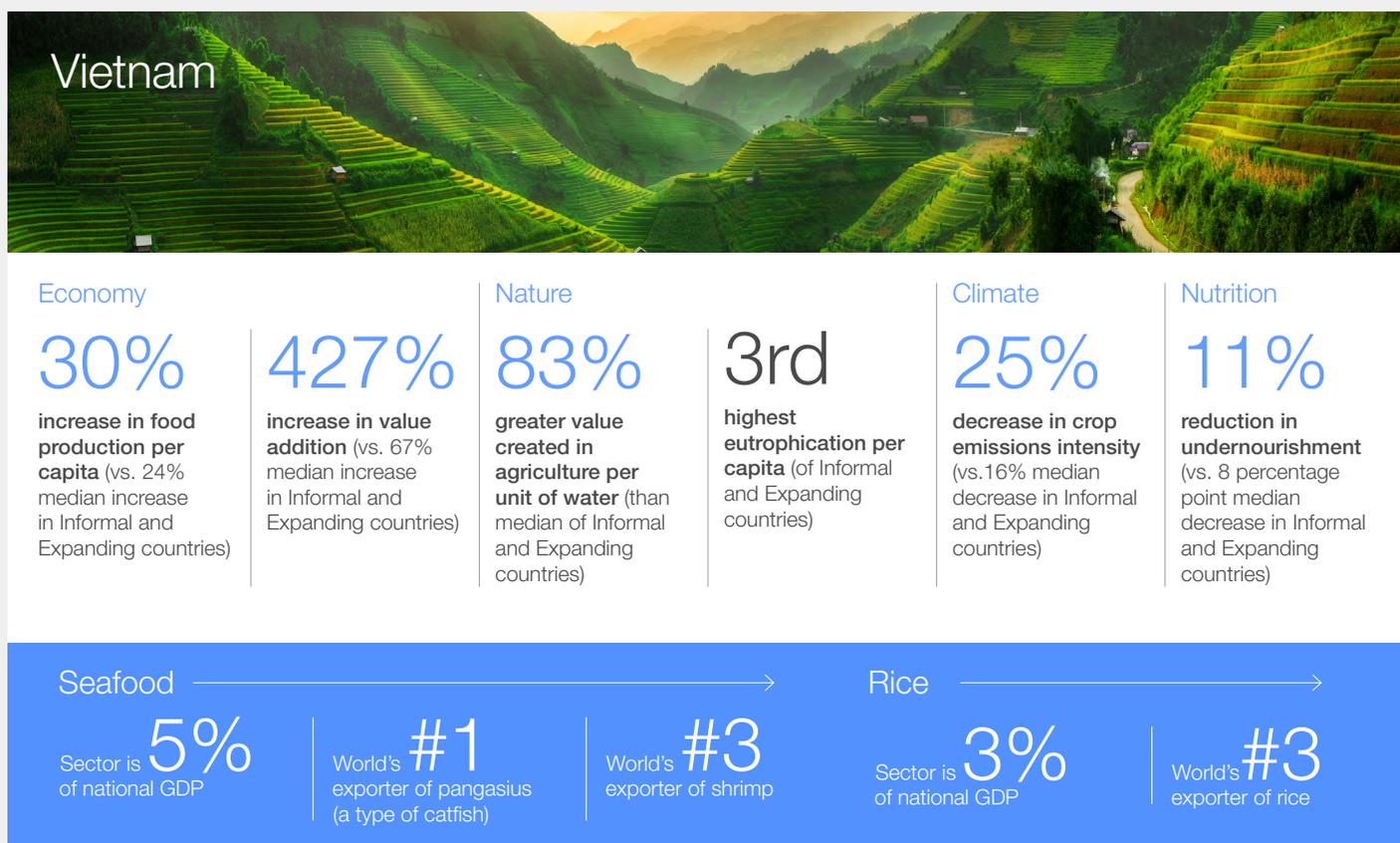
### Early mover profile: Vietnam

India's dairy and agritech sector transformation shows how government infrastructure investments and policy initiatives can unlock private sector investments and enterprise growth to achieve broad-based food systems outcomes. While Vietnam's food systems successes follow a largely similar repeatable model, the public and private sectors have interacted in different and interesting ways. In Vietnam, there has been a greater use of blended financing (interest subsidies, for example). International financing from development banks and investors has played a greater role, as have public-private partnerships, exemplified by the establishment of the Partnership for Sustainable Agriculture in Vietnam (PSAV). PSAV set in motion partnerships between the public and private sectors across multiple commodities – including fisheries, rice, and fruits and vegetables – with working groups promoting value-chain linkages and scaling-up sustainable practices. There has been early promise in the coffee sector too, where such collaboration has resulted in growth in production, productivity and exports, while subsequent efforts to address negative externalities have increased fertilizer efficiency and halved emissions intensity.<sup>119</sup>

Perhaps the most powerful illustration of the repeatable sector transformation model in Vietnam is from the seafood sector. With its long coastline, abundant coastal waterways and tropical climate, Vietnam enjoys a natural advantage in fishery production.<sup>120</sup> In the mid-2000s Vietnam prioritized seafood – in particular pangasius (a type of catfish, often sold as swai or basa) and shrimp. Domestic demand was strong – Vietnamese consume 27kg of seafood per person each year, compared to 9kg in the US –<sup>121, 122</sup> but the country focused on exports,<sup>123</sup> with opportunities flowing from Vietnam's membership of the World Trade Organization (WTO) in 2007 and high demand for seafood coming from the European Union (EU), United States and Japan. Improving the quality and traceability of Vietnamese products would prove essential for producers to meet stringent standards and gain market access, while improving quality for domestic consumers as a bonus.<sup>124, 125</sup> Through a combination of smart government policy, mutually reinforcing public and private investments, and the growth of vertically integrated enterprises, Vietnam grew aquaculture production 11.6% per year and seafood processing 9.7% per year from 2000 to 2020.<sup>126, 127</sup> The country is now the world's number one exporter of pangasius, and today the seafood industry accounts for 5% of Vietnam's GDP.<sup>128, 129</sup>

“ Vietnam grew seafood sectors through a combination of smart government policy, mutually reinforcing public and private investments, and the growth of vertically integrated enterprises.

FIGURE 8 | Vietnam – numbers at a glance



Sources: FAO,<sup>130</sup> World Bank,<sup>131</sup> IHS Markit,<sup>132</sup> Observatory of Economic Complexity (OEC),<sup>133</sup> WWF.<sup>134</sup>

Notes: Increase in food production per capita is from 2002-2018 using trailing 3-year average. Value addition in \$ millions (2015) is from 2002-2021. Water use efficiency uses average values (\$ per m<sup>3</sup>) in agriculture from 2017-2019. Eutrophication uses 2019 data. Crop emissions intensity is from 2002-2018 and measures tonnes of CO<sub>2</sub> equivalent per tonne of production. Undernourishment rate is from 2002-2019. Seafood contribution to GDP is in 2016. No. 1 exporter of pangasius is in 2020. No. 3 exporter of shrimp is in 2020. Rice contribution to GDP is in 2021. No. 3 rice exporter is in 2020.

“ From 2016-2020, the Vietnamese government spent \$11.3 billion to upgrade the Mekong Delta’s transport, agriculture and fisheries infrastructure. This primed foreign investment which, by 2019, totalled more than \$11 billion into over 700 food processing projects.

The government created a strong enabling environment to support the sustainable growth of the seafood sector. The 10-year national strategy in 2005 laid out a clear roadmap to grow the sector by boosting aquaculture, exports, product diversification and better processing technology.<sup>135</sup> Fishery laws set out regulations for the sustainable development of fisheries as well as provisions for marine conservation. Over the same period, certification regimes focused on improving the quality and safety of seafood products, and domestic standards were harmonized with international ones to facilitate adherence by domestic producers and strengthen export competitiveness.<sup>136, 137, 138</sup>

Mutually reinforcing public and private financing have been critical. Concessionary lending programmes were put in place instructing local commercial banks to provide credit at below market rates to domestic companies working in high-tech agriculture.<sup>139</sup> In 2012, the national government allotted \$210 million to support banks offering loans at preferential rates to pangasius farmers experiencing input price spikes.<sup>140, 141</sup>

In 2017, the Ho Chi Minh City government committed to subsidize 80% of interest payments for 12 months on bank loans for investment in aquaculture projects.<sup>142</sup>

From 1999 to 2005, the World Bank invested \$148 million in infrastructure systems to support irrigation, flood protection and salinity prevention in the Mekong Delta, the most productive fisheries region.<sup>143</sup> Then building on these efforts, the Vietnamese government spent \$11.3 billion between 2016 and 2020 to upgrade the Mekong Delta’s transport, agriculture and fisheries infrastructure.<sup>144, 145</sup> This primed foreign investment and, by 2019, international investors had put more than \$11 billion into over 700 food processing projects.<sup>146</sup> The International Bank for Reconstruction and Development and the World Bank’s recent agreement to lend more than \$26 million for aquaculture infrastructure in the Mekong Delta over the next three years is expected to crowd in further government and private investment.<sup>147</sup>

Amidst this broad government support and expanded financing, a number of vertically

integrated seafood companies have become national champions, spurring Vietnam to emerge as the world's third largest shrimp exporter with a 13% share of the global market.<sup>148, 149</sup> One such champion is Minh Phu, now Vietnam's largest shrimp processor with \$644 million in export revenues.<sup>150</sup> Today Minh Phu owns the entire value chain from hatcheries through to processing and transportation, often integrating key capabilities through joint ventures such as Grominh (with Grobest of Taiwan) to produce shrimp feed and Mekong Logistics (with Gemadept Logistics of Vietnam) to provide a cold storage and transportation network.<sup>151, 152, 153</sup> The company is leading the digital transformation of seafood processing, using artificial intelligence to feed shrimp more efficiently and measure water quality in ponds.<sup>154</sup> In 2019, Japanese conglomerate Mitsui & Co invested \$100 million for one-third ownership of the group's Minh Phu Hau Giang affiliate – financing that contributed to the construction of a breaded shrimp processing plant with a 40,000-ton annual capacity.<sup>155</sup>

This vertical integration has improved traceability and supported financially beneficial long-term purchase guarantee contracts.<sup>156</sup> Farmer-allied behaviours that have improved livelihoods include guaranteeing offtake for small-scale producers under contract farming arrangements to provide price certainty and, in turn, supporting their investment in inputs.<sup>157</sup> Vinh Hoan, another leading vertically integrated player, is the world's top pangasius producer with \$276 million in revenue.<sup>158</sup> It also provides technical support and disease control guidance to its small-scale producers, helping them achieve GlobalG.A.P. Certification.<sup>159, 160</sup>

While the aquaculture industry continues to grapple with sustainability issues, these vertically integrated companies are innovating. Minh Phu is investing in organic shrimp farming, building a wastewater treatment plant, integrating shrimp and rice farming, and building social housing for its employees.<sup>161</sup> Vinh Hoan is bringing its circular economy model to pangasius, making productive use of fish by-products through, for example, extracting collagen from fish skin for beauty and pharma products and turning processing offcuts into fish meal.<sup>162</sup>

Vietnam's support and investments in the seafood sector represent a qualified success, as it has come with some trade-offs across the broader system. Increased activity in the Mekong has had an environmental cost with Vietnam's per-capita eutrophication the third highest among its peer countries.<sup>163</sup> And while Vinh Hoan does generate approximately 16% of its sales domestically and the growth of this sector did support 5.6% growth in domestic per capita consumption of shrimp and fish (by weight) from 2010 to 2020, much of the economic growth has come from export expansion.<sup>164, 165</sup>

Due in part to the performance of its seafood processing industry, Vietnam has had 9% compound annual growth in value addition in food manufacturing over the last two decades.<sup>166</sup> As this report will show in Chapter 3, the country's efforts in rice, while still oriented around improving productivity, have more explicitly focused on additional food systems dimensions, including farmer livelihoods, nutrition security and the environment.

### BOX 3 Vietnam seafood – key takeaways

- Infrastructure investments, long-range roadmaps and a comprehensive regulatory framework (encompassing quality standards, sustainability practices and marine conservation) have created a strong enabling environment which can provide a path for the sustainable development of Vietnam's seafood sector, especially in exports.
- Use of blended financing (e.g. concessional lending, interest subsidies) have unlocked local commercial lending. Catalytic international development financing has helped crowd-in additional public and private investments.
- Scaled-up, farmer-allied, vertically integrated seafood companies have helped propel Vietnam to leading global exporter status, driving economic growth and innovation in digital and sustainability practices (e.g. supply chain traceability, AI-powered precision feeding and circularity).



“ Growth in food production in Ghana over the last 20 years has more than halved undernourishment.

## Early mover profile: Ghana

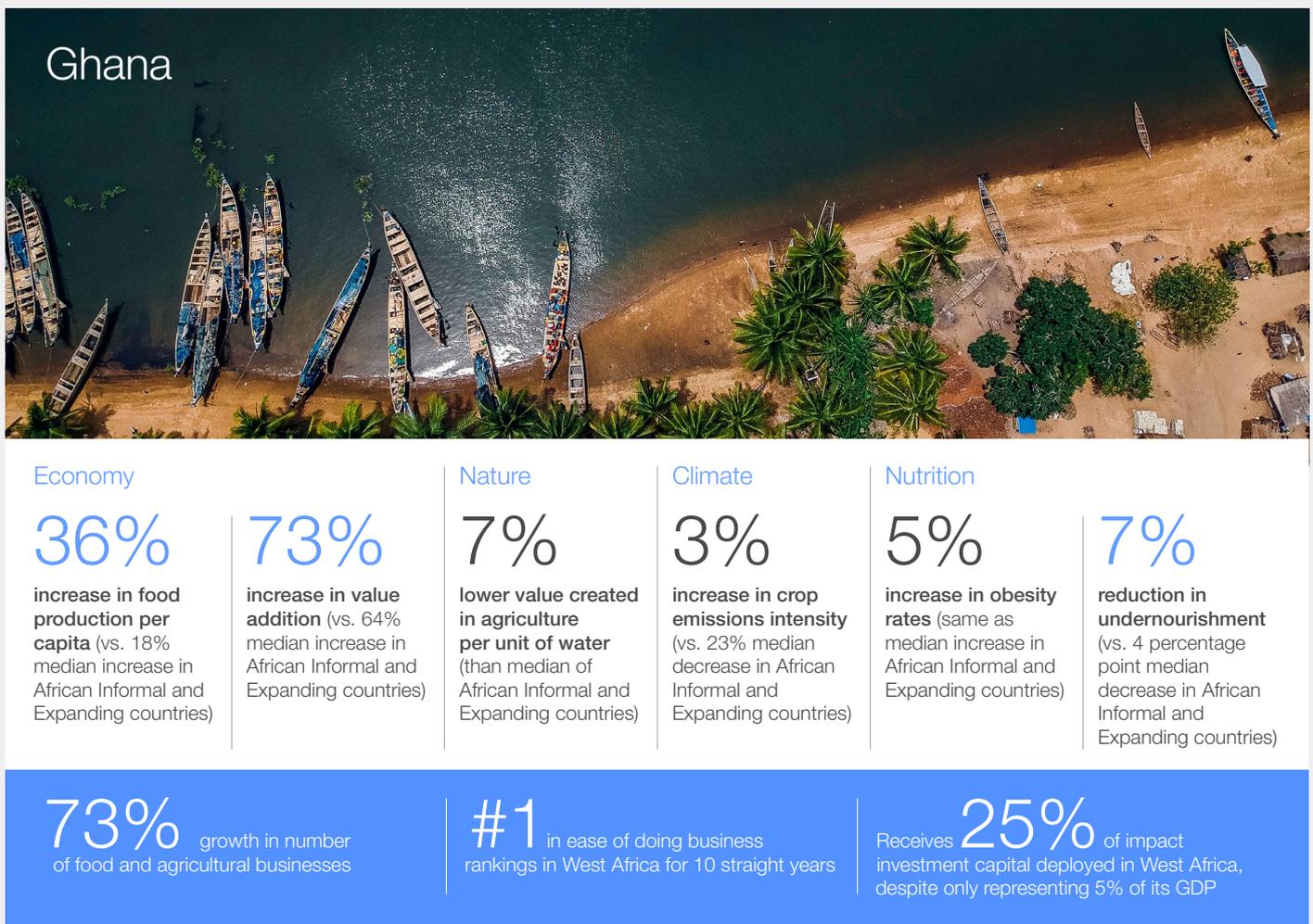
Ghana’s food systems transformation model shares repeatable elements with those of India and Vietnam. But Ghana’s journey is distinctive in its outsized focus on growing small -and medium-sized enterprises within the hidden middle as key to improving outcomes across multiple food system dimensions. The government initially focused on staple crops such as cassava, yams, maize and rice, but more recently it has added higher-margin commodities like horticulture, putting a particular focus on SMEs that act as aggregators, distributors, processors and packagers throughout the value chain.

Under the 2007 Food and Agriculture Sector Development Policy II (FASDEPII), Ghana’s

government shifted to a value-chain approach that prioritized specific commodities and private sector engagement. This focus has helped double the growth rate of Ghana’s per capita food production and supported the development of strong processing enterprises that are creating new levels of economic contribution through value-added horticultural products such as juices and cut fruit.<sup>167, 168, 169, 170, 171</sup> Overall, growth in food production over the last 20 years has more than halved undernourishment, which is down seven percentage points from 2002-2019.<sup>172, 173</sup>

However, there are trade-offs. For example, Ghana lags its African peers on water-use efficiency in agriculture. Meanwhile the GHG emissions intensity of its crops increased by 3% from 2002 to 2018 – a period when the country’s peers saw a 23% reduction.<sup>174, 175</sup>

FIGURE 9 Ghana – numbers at a glance



Sources: FAO,<sup>176</sup> World Bank,<sup>177</sup> Ghana Open Data Initiative,<sup>178</sup> IHS Markit,<sup>179</sup> Global Impact Investing Network,<sup>180</sup> Euromonitor.<sup>181</sup>

Notes: Growth in food production per capita is from 2002-2018, using trailing 3-year average. Value addition in \$ millions (2015) is from 2002-2021. Water usage efficiency is using average values (\$ per m<sup>3</sup>) in agriculture from 2017-2019. Crop emissions intensity increase is from 2002-2018 and measures tonnes of CO<sub>2</sub> equivalent per tonne of production. Obesity rate growth is from 2002-2019. Undernourishment rate decrease is from 2002-2019. Growth in food and agriculture businesses is from 2015-2018. No. 1 West Africa ease of doing business ranking is from 2010-2019 looking at 16 countries using the World Bank’s Doing Business report rankings. Impact investment data is from 2015.

“ The scaling-up of farmer-allied aggregation models could unlock greater local sourcing and more profitable growth for processors operating in lower-margin output markets serving domestic consumers.

FASDEP II and successive government policies and programmes have focused on creating an enabling environment aimed at increasing the economic value captured domestically – and doing so, importantly, through the growth of SMEs. The 1 District 1 Factory (1D1F) programme, launched in 2017 and run by the Ministry of Trade and Industry, exemplifies this approach.<sup>182, 183</sup> With value-added food manufacturing among its top priorities, 1D1F aims to increase the capacity for “Made in Ghana” goods by putting one factory in each of Ghana’s 216 districts, catering to the comparative economic advantages of each locale.<sup>184</sup> As of 2021, 232 1D1F factories are at various stages of implementation in 154 districts.<sup>185, 186, 187</sup> The programme provides support services to businesses, such as coordinating access to financing from financial institutions, subsidizing interest rates for certain projects, and infrastructure support. The success of these efforts is evident in Ghana’s consistently high performance in the World Bank’s ease of doing business index, where it ranked first among 16 West African countries from 2010-2019.<sup>188</sup>

Government financing has contributed significantly to the enabling environment. The Ghanaian government has directed public funding towards improving farmer productivity through enhanced inputs such as seeds and fertilizer, irrigation, subsidized mechanization and extension services. The resulting increases in crop production, combined with efforts to create a more conducive business environment, have helped catalyse growth in SME lending, with both domestic banks and international institutions extending financing access to Ghana’s agricultural sector. Over the past 11 years, Ghana’s Agricultural Development Bank (ADB), for example, has increased agriculture-based lending by nearly 300%.<sup>189</sup> 1D1F has contributed to this growth by de-risking project financing through its support services, including interest subsidies valued at \$52 million between 2017 and 2021 for loans from various domestic institutions, including the ADB.<sup>190, 191</sup>

Alongside this growth in domestic lending, Ghana has received significant development financing from international institutions. Some \$450 million in grants and low-interest loans in 2020 and 2021 from the International Development Association and the European Investment Bank helped fund the set-up of the Development Bank of Ghana, which now aims to increase its share of loans to small businesses from 9% today to 15% by 2024.<sup>192, 193, 194, 195</sup> In addition, public and private collaborations such as the Venture Capital Trust Fund, a quasi-public group bringing together funding institutions to facilitate SME access to long-term credit, have further promoted private sector growth.<sup>196</sup>

Fuelled by these increases in access to credit and a strengthened enabling environment, Ghana’s agricultural sector has seen an explosion in SME growth, with the number of registered businesses in Ghana associated with food and agriculture up 73% from 2015 to 2018.<sup>197</sup> This growth has coincided

with a demonstrated increase in domestic value addition. The percentage of processed fruit and vegetable goods on the retail shelf that were produced by a Ghanaian enterprise increased thirty percentage points to 51% from 2015 to 2021.<sup>198, 199</sup>

Similar to the entrepreneurial success stories in the Indian dairy and Vietnamese seafood sectors, one of Ghana’s most successful enterprises is a vertically integrated, farmer-allied company called Blue Skies, founded in Ghana but now operating internationally. Blue Skies, which sources pineapples, coconuts and other local fruit from smallholder farmers, generates more than \$100 million in revenues and employs over 3,000 people in West Africa.<sup>200, 201, 202, 203</sup> The company processes the fruits locally to ensure that value addition takes place domestically and estimates that its practice of “adding value at the source” allows the origin country to retain 75% of the value of the finished product, versus 15% when inputs are exported and processed overseas.<sup>204</sup> In addition to providing consistent demand, Blue Skies reduces barriers for smallholder farmers selling their products into Europe by developing the local cold chain and managing supplier export standards. The company’s other farmer-allied practices include providing farmer training to increase production, offering advance payment and loans, and providing agronomic support to farmers battling bacterial black spots.<sup>205, 206</sup>

Alongside vertically integrated companies in horticulture, SME aggregators with promising farmer-allied sourcing models have emerged in lower-margin output markets. For example, Farmer Pride, supported by initial donor funding from the Market Development Programme for Northern Ghana (MADE), has built a commercially viable business in selling high-quality seeds and other inputs to smallholder farmers of maize, soya and groundnuts, while providing harvesting assistance as well as post-harvest support services such as crushing and aggregating products for buyers. The company works with 2,500 smallholder farmers of lower-margin commodities in eight districts. The scaling-up of these kinds of aggregation models could unlock greater local sourcing and more profitable growth for processors operating in lower-margin output markets serving domestic consumers.

Ghana’s progress is promising, but financing remains a challenge for small- and medium-sized enterprises across Sub-Saharan Africa due to high interest rates and collateral requirements. According to a recent report from ISF Advisors and CASA (Commercial Agriculture for Smallholders and Agribusiness), 83% of agricultural SME financing needs in Sub-Saharan Africa – some \$74.5 billion – remain unmet.<sup>207</sup> This financing gap reflects the high degree of systemic risk inherent in African smallholder agriculture and the firm-level risk that is often due to suboptimal management, financial and technical expertise in smaller enterprises. Unleashing the power of the hidden middle,

especially farmer-allied enterprises, as linchpins of broad-based food systems development will require much greater coordination between public and private actors and significantly expanded use of blended financing mechanisms such as credit guarantees and concessionary lines of credit, interest subsidies, first-loss vehicles and technical assistance facilities.

Ghana's transformation story to date has focused on economic growth and nutrition security. As with the country profiles shared above, it remains a work in progress. As climate change threatens farmers' livelihoods and increases the systemic risks faced by agricultural SMEs, the need for innovation will

be greater than ever – especially innovation in the inputs, technologies and practices that will help farmers to adapt while growing production, and in the financing instruments and insurance mechanisms that can mitigate risks for both farmers and the enterprises that source from them. Innovation – and the public-private collaboration that help innovation ecosystems thrive – will be key to building more resilient food systems. Meanwhile, given that undernourishment declined while obesity rates rose to 10.6% in 2019 (compared to an African median of 8.6%),<sup>208, 209</sup> Ghana will need to shape healthier consumption patterns while continuing to improve nutrition security. These subjects are addressed in the next chapter.

#### BOX 4 Ghana – key takeaways

- While continuing its investment in productivity improvement, the government is increasingly focused on growing SMEs in the hidden middle of food value chains as key to driving economic growth.
- International development grants and concessionary financing played a catalytic role in expanding SME credit access and supporting enterprise development; blended financing (e.g. interest subsidies and provision of business support services) unlocked greater domestic lending.
- Scaled-up, farmer-allied, vertically integrated and aggregator models promise to increase local sourcing and anchor more resilient food systems. Aggregator models can be particularly relevant in low-margin output markets that serve domestic consumers.
- In Sub-Saharan Africa, enabling more of these high-potential, farmer-allied enterprises to scale-up will require closing the massive agricultural SME financing gap. This, in turn, will require much greater public-private coordination and expanded use of blended financing as de-risking mechanisms.
- Incentive models supporting more holistic food systems transformation can complement sector growth to ensure more balanced outcomes.



3

# How to build sustainable, healthy, productive food systems

The urgency of global food systems challenges – from climate and biodiversity to food security and nutrition – requires concurrent implementation of transformation levers.



“ Developing and emerging countries need to find ways to improve productivity and food security while simultaneously adapting to and mitigating their impacts on climate and nature.

Innovation and investment in the food systems of more developed economies have historically focused on increasing productivity and expanding midstream and downstream activities beyond the farm gate. As these agricultural sectors and economies have developed, rising pressures on natural resources like land and water, combined with the recognition of substantial agriculture-related GHG emissions, have slowly begun to push food systems towards more sustainable practices. However, while many developed countries are now among the most agriculturally productive with high value addition per capita, they remain some of the biggest GHG emitters and users of natural resources. Similarly, as incomes in these countries have grown, diets have shifted towards higher consumption of total calories, sugar and processed foods, leading to an increase in diet-related health issues. Diets have also shifted towards excess consumption of animal proteins, particularly red meat, which carry a significant resource and greenhouse gas footprint.

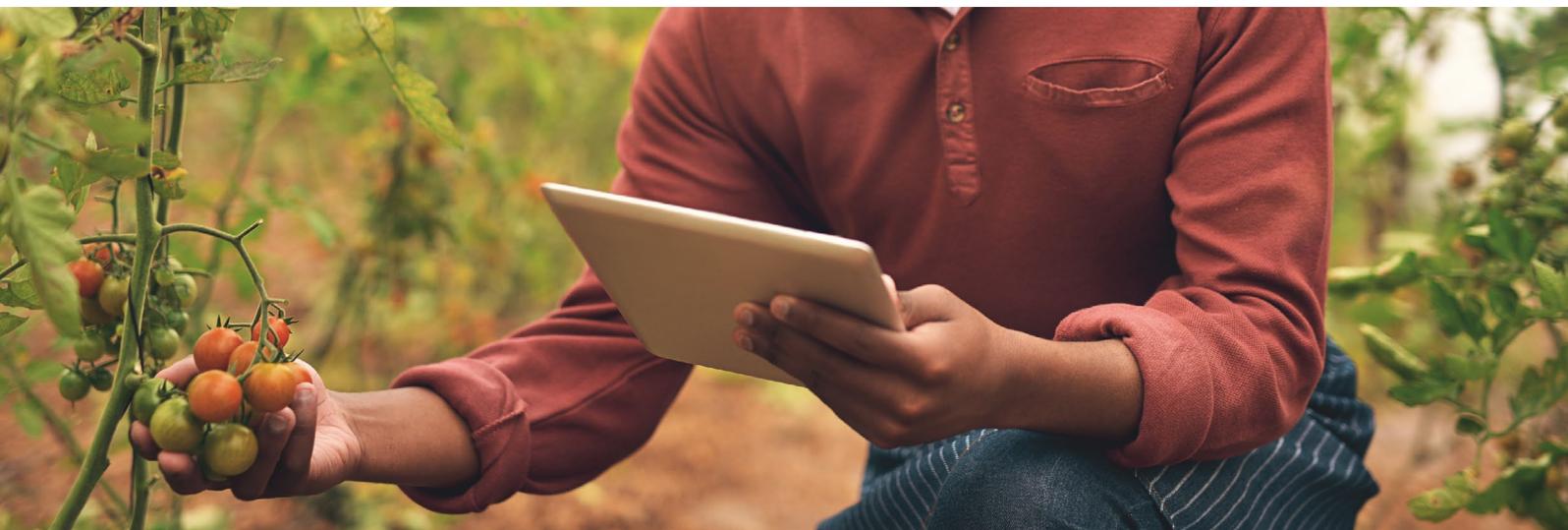
This sequential approach to transformation cannot be repeated if the world hopes to accelerate progress towards food systems that are truly better for people and planet. Developing and emerging countries need to find ways to improve productivity and food security while simultaneously adapting to and mitigating their impacts on climate and nature. At the same time, developed countries must

work harder and faster to address and reverse the negative externalities – in health, environment and livelihoods – associated with their food systems.

This chapter presents two emerging countries – Algeria and Vietnam – that, through innovation, have optimized both productivity and sustainability to achieve economic growth, improved livelihoods and a positive impact on climate and nature, while at the same time improving food security and nutrition. The chapter also profiles how innovation ecosystems in Canada supported the large-scale adoption of conservation tillage practices, a subset of regenerative agriculture. The three countries share common factors that successfully drove farmer adoption, but also illustrate how innovation ecosystems can emerge in different ways.

This chapter closes by arguing that large-scale shifts in food production and consumption will only be possible with the concurrent activation of multiple levers including:

- Public policy, regulations and related tools
- Innovation and innovation ecosystems
- Public and private investments
- Corporate action and aligned multi-stakeholder coalitions



### 3.1 Fostering innovation to improve productivity, nutrition security and sustainability

Innovation – in agricultural practices and technologies (including inputs) – is how developing and emerging countries can balance productivity and economic growth with improved outcomes in nutrition security, environmental impact, climate resilience, inclusion and livelihoods. In the two examples below, one

country faces acute natural resource constraints, while the other faces the fact that production of a priority crop entails significant GHG emissions and impact on nature. Both have successfully managed this balancing act – but the more surprising of the two stories comes from north-west Africa.

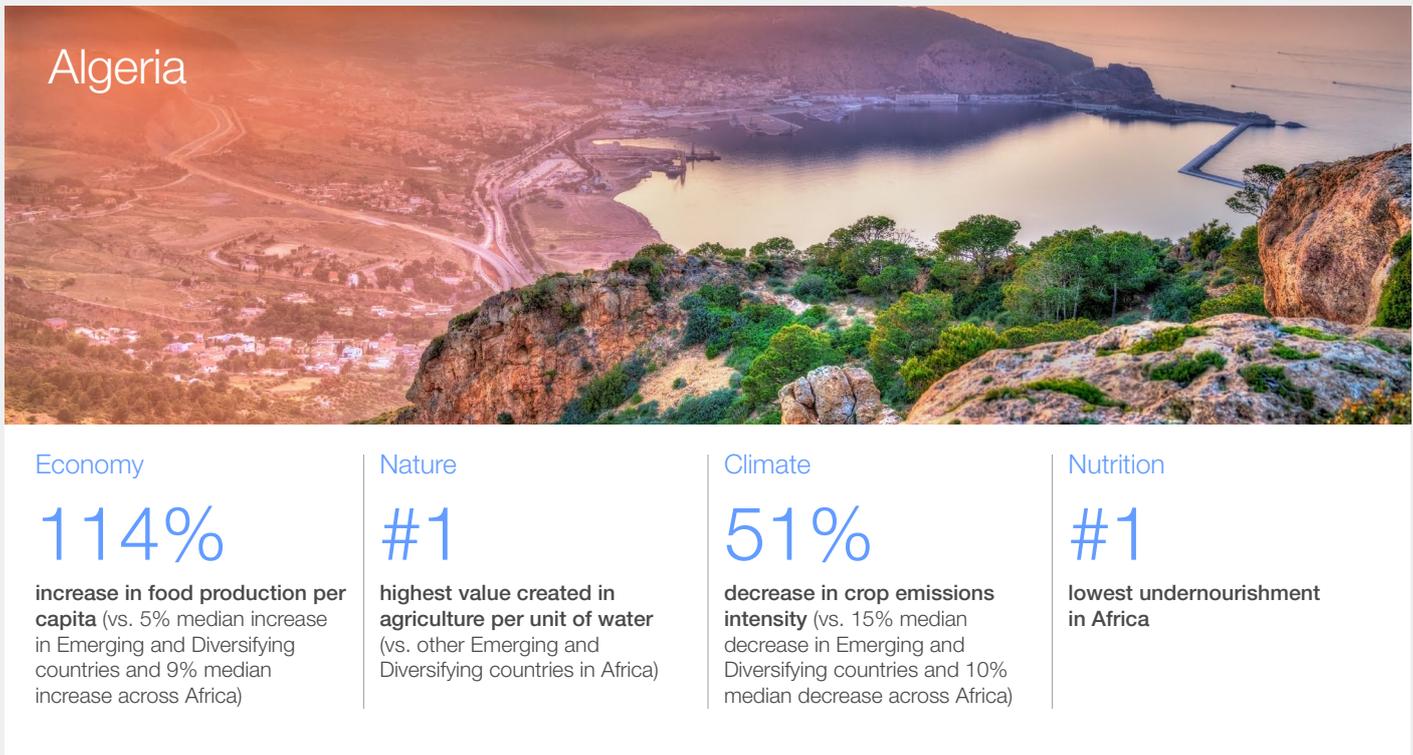
## Overcoming resource scarcity through innovation in Algeria and the Maghreb

Situated in the Maghreb, Algeria is the largest country in Africa by area. Most of its population lives along the country's northern Mediterranean coast.<sup>210</sup>

Low rainfall leaves just 17% of its land suitable for agriculture and desertification is affecting many of the country's south-western regions bordering the Sahara.<sup>211, 212</sup> Only 3% of Algeria's agricultural land is irrigated and poorly maintained infrastructure wastes up to 30% of the already-limited water during transportation and piping.<sup>213, 214</sup>

FIGURE 10

Algeria – numbers at a glance



Sources: FAO,<sup>215</sup> World Food Programme.<sup>216</sup>

Notes: Growth in food production per capita is from 2002-2018, using trailing 3-year average. No. 1 highest water use efficiency is from 2017-2019, measured in \$ per m<sup>3</sup> for agriculture. Crop emissions intensity measures tonnes of CO<sub>2</sub> equivalent per tonne of production from 2002-2018. Lowest undernourishment in Africa is from 2019.

“ Since 2000, Algeria has more than doubled its per capita food production, while undernourishment has dropped from 8% of the population to less than 3% – the lowest in Africa.

Yet against this unpromising sounding backdrop, Algeria has scored some notable food system successes, catalysed by government programmes and enabled by farming innovations. The country has more than doubled its per capita food production since 2000.<sup>217, 218</sup> Undernourishment dropped from 8% of the population in 2001 to less than 3% in 2019 – the lowest in Africa.<sup>219</sup> At the same time, Algeria has the highest water-use efficiency in agriculture anywhere in Africa and has meaningfully reduced crop emissions intensity relative to countries with similar food systems in Africa.<sup>220, 221</sup>

Between 2000 and 2020, 21% of Algeria's GDP came from oil.<sup>222</sup> In order to reduce its dependence on imports and create food security independent of fluctuations in global oil prices, the government took a series of actions starting with the National Agricultural and Rural Development Program in

2000 to boost domestic agricultural production. Most significant was the Agricultural and Rural Renewal Program launched in 2010, incentivizing farmers to switch to higher-yielding varieties of staple crops like wheat and increasing fertilizer subsidies to 50% of cost.<sup>223</sup> Bonuses were given to farmers who achieved large harvests of short-cycle crops such as tomatoes that satisfy local demand and require little water to achieve high yields. In some cases, the government has limited the import of products that can be produced locally such as tomato paste.<sup>224</sup> Building on its existing land allocation systems, the Ministry of Agriculture began granting additional land to farmers who switched to high-value food crops that are expensive to import, like bananas.<sup>225</sup>

A crucial complement to this government support was the introduction of innovative irrigation systems. In the El Oued desert region, for example, rotating

sprinklers that draw from water tables beneath the desert (a modern version of the traditional “Ghout” irrigation technique) are used in areas with full sun that are ideal for growing fruits and vegetables.<sup>226, 227</sup> For its part, the Ministry of Agriculture has deployed several satellites and 100 drones to identify irrigation needs.<sup>228</sup> The government has also encouraged private sector investment by removing most foreign ownership restrictions and has sought to further boost agricultural production by lifting bans on the import of agricultural equipment.<sup>229</sup> In the desert city of Touggourt, Algeria’s National Office of Irrigation and Drainage collaborated with Spanish company Alcantara Systems on a \$10.3 million public-private partnership to build a complex of horticultural greenhouses.<sup>230</sup> Powered by fully renewable geothermal energy, the greenhouses are expected to increase yields significantly, while keeping water use, energy costs and emissions low.<sup>231</sup>

Other parts of the Maghreb are similarly pursuing innovation to balance productivity, food security and sustainability. The government of Morocco’s Agricultural Development Agency is working to attract outside funding for projects that boost agricultural resilience to climate change.<sup>232</sup> Research into smart farming conducted at Mohammed VI Polytechnic University has prompted farmers in the dry Rhamna province to switch crops from wheat to more drought-tolerant quinoa and to experiment with drones to detect pests, water stress and crop nutrient deficiencies on farms.<sup>233</sup> Tunisia’s National Gene Bank collects and catalogues traditional and indigenous seeds, that are typically more resilient to disease and the impacts of climate change, from local farmers and global seed banks. Using these seeds, farmers have reported higher yields with less pesticide use.<sup>234</sup>

## BOX 5

### Algeria – key takeaways

- With only 17% of land suitable for agriculture, Algeria invested in innovative irrigation systems to boost productivity, improve food security and maximize water-use efficiency.
- Multi-year government programmes – from farmer incentives and land grants to the removal of barriers to foreign ownership and equipment imports – have focused on boosting the production of staple and higher-

margin crops and reducing the country’s dependence on food imports.

- More broadly in the Maghreb, innovations in – among other things – crop choice, seed varieties, greenhouses and drone technology are being actively pursued to improve productivity and food security, while minimizing emissions and resource use, and adapting to the impacts of climate change.

### 4As of Adoption – a repeatable model for balanced growth

Innovation in horticulture and other commodities in the Maghreb illustrates how countries and regions can expand production while driving broader food systems outcomes, by improving food security, adapting to climate change and managing demands on limited natural resources. Such an approach has also enabled Vietnam to achieve balanced outcomes while becoming a major producer and exporter of a priority commodity – rice. Importantly, Vietnam has been able to secure significant adoption of sustainable food production by following a farmer-centric model that promotes the adoption of new practices.

The experience of Vietnam and other examples in the section above points to a repeatable model that encourages and enables farmers to adopt

and scale-up climate-smart and nature-positive practices and technologies – the “4As of Adoption” (see Figure 11):

- **Awareness:** Farmers must know about climate-smart and nature-positive practices and technologies, and have the technical expertise and support to implement them.
- **Advantage:** Farmers must have confidence that adopting new practices and technologies will provide an attractive rate of return.
- **Access:** The right inputs, equipment and methods must be available to farmers when and where they need them.
- **Affordability:** Upfront costs for farmers must be reasonable, with affordable financing available to support initial investments.

“ Vietnam has been able to secure significant adoption of climate-smart and nature-positive food production by following a farmer-centric model that promotes the adoption of new practices.

FIGURE 11 | Repeatable model #2: The 4As of Adoption to scale-up climate-smart, nature-positive production

A range of actions can support the adoption and scaling of climate-smart, nature-positive production practices and technologies	
 <p><b>Awareness</b> Improve farmers' awareness of climate-smart, nature-positive practices and technologies, and the technical expertise to implement them</p>	<ul style="list-style-type: none"> <li>– Governments fund “human infrastructure”, and region-specific practice and technology innovation (e.g. local farmer groups, extension officers, researchers)</li> <li>– Trusted advisors demonstrate benefits in local settings, facilitate peer-to-peer sharing and provide technical expertise</li> <li>– Early adopters share success stories</li> </ul>
 <p><b>Advantage</b> Build farmers' confidence that adopting new practices and technologies will bring an attractive return</p>	<ul style="list-style-type: none"> <li>– Fair and reliable offtake prices and quantities</li> <li>– Companies commercialize products that “pull” demand for sustainably produced ingredients</li> <li>– “Price in” externalities with government subsidies, taxes and other measures</li> <li>– Payments for ecosystem services and other incentives to adopt new practices and technologies</li> </ul>
 <p><b>Access</b> Ensure technologies (inputs, tools, equipment and methods) are available to farmers when and where needed</p>	<ul style="list-style-type: none"> <li>– Companies invest in practice and technology innovation (e.g. equipment, inputs, digital monitoring, reporting and verification tools etc.)</li> <li>– Governments subsidize innovation to fill gaps (e.g. high-risk pilots, non-excludable goods) or provide a positive signal to private investors</li> <li>– “Last mile” access to solutions when and where farmers need them (given purchasing habits, transport constraints, growing cycles)</li> </ul>
 <p><b>Affordability</b> Reduce upfront costs for farmers and increase accessibility of affordable financing</p>	<ul style="list-style-type: none"> <li>– Preferential or subsidized credit access and insurance offerings to producers for climate-smart investments</li> <li>– Risk-reduction arrangements for sustainably produced food (e.g. long-term purchase agreements)</li> <li>– Inputs for sustainable production are lower-cost or subsidized; necessary equipment is available at relatively low prices or on contract/as-a-service</li> </ul>

## Nature-positive, climate-smart rice farming in Vietnam and Southeast Asia

Like Algeria, Vietnam must balance multiple food system dimensions, including agricultural and economic expansion, food security, and nature and climate impacts. While Vietnam's seafood sector development has led to strong economic outcomes (see section 2.3), its efforts in the rice sector – similarly critical to the Vietnamese diet and economy – have focused more explicitly on nature and climate impacts.

In Vietnam, rice supplies 66% of dietary calories, as well as generating livelihoods for 15% of the population and 3% of GDP.<sup>235, 236, 237</sup> But farming rice traditionally requires vast amounts of water and, in Vietnam, it is responsible for 48% of agricultural GHG emissions and more than 75% of methane emissions.<sup>238</sup>

In addition to focusing its policies and direct investment on improving rice productivity, the government catalysed an innovation ecosystem around sustainable rice farming through the System of Rice Intensification (SRI). SRI is a method first developed in Madagascar in the early 1980s that embraces a variety of climate-smart approaches to

increase the productivity of irrigated rice, while using fewer inputs than traditional rice farming. SRI's water management techniques lead to soils emitting less methane and sequestering more carbon, while using less chemical fertilizer that further reduces greenhouse gas emissions.<sup>239, 240</sup> An academic community centred at Cornell University in the US played a key role in promoting the benefits of SRI internationally, inspiring government agencies and NGOs in rice-producing countries, such as Vietnam, to take action.<sup>241</sup>

Four key factors – the 4As of Adoption – helped increase the uptake of SRI in Vietnam:

- **Awareness:** Vietnam's Ministry of Agriculture and Rural Development's Plant Protection Department and NGOs supported local experiments and farmer field schools to promote SRI's techniques to farmers at no cost.<sup>242, 243</sup> Early adopting farmers shared their own evidence of SRI's effectiveness (e.g. abundant seedlings) to help break down bias against an unconventional approach.<sup>244</sup>
- **Advantage:** With government support, Cornell collaborated with leading Vietnamese universities to build a strong base of scientific evidence. They found that SRI boosts yield by 20-50%, using as little as half as much

“ Rice farming is responsible for 48% of Vietnam's agricultural greenhouse gas emissions and over 75% of methane emissions.

water and just 10-20% of the typical amount of seed.<sup>245</sup> With the support of NGOs and the government, farmer field schools spread the results to farmers, who could see the financial benefits for themselves within one growing season of adoption.<sup>246</sup>

- **Access:** Vietnam’s Ministry of Agriculture and Rural Development invested in research and development through the formerly state-owned seed company Vinaseed, which leads the sale and distribution of rice seeds to farmers.<sup>247, 248</sup> In addition, government-financed irrigation infrastructure allows farmers to water their rice crops and apply carbon-reducing watering techniques such as Alternating Wetting and Drying (AWD).<sup>249</sup>
- **Affordability:** The government offered a one-time 30% price subsidy on certified seeds and attracted donor funding to support experiments in, and the rollout of, SRI techniques.<sup>250, 251</sup>

By 2015, approximately a decade after SRI was introduced, 1.8 million Vietnamese farmers had

adopted SRI techniques, making it the most successful country in SRI adoption according to experts.<sup>252</sup> SRI has made inroads in nearby countries as well, including India and Cambodia. As of 2018, countries with some level of SRI adoption accounted for 96% of global rice cultivation, according to FAO data.<sup>253, 254</sup>

Vietnam continues to push for faster reduction of GHG emissions, having committed to achieve net-zero emissions by 2050, with the World Bank providing \$183 million from 2015 to 2022 to support the adoption of sustainable rice farming in the Mekong Delta.<sup>255, 256, 257</sup>

Additional opportunity may exist for Vietnam and other major rice-producing countries if downstream players such as importers, distributors and retailers can generate greater consumer demand for low-carbon, climate-smart rice and charge a price premium to consumers interested in a more sustainable product. Improved traceability from farm to consumer can also help make it possible to capture this value.

## BOX 6

### Vietnam – key takeaways

- Rice is a staple crop and major source of livelihoods in Vietnam, but represents nearly half of the country’s agricultural GHG emissions.
- The System of Rice Intensification (SRI) — an innovative set of rice farming techniques that improve yields, reduce water and input use, and lower GHG emissions — is helping Vietnam optimize its food system outcomes.
- Collaboration between the government, academic communities, international development financing institutions and NGOs provided the critical knowledge, funding, inputs, infrastructure and other support to create the necessary ecosystem to drive widespread farmer adoption of SRI.

## 3.2 Scaling-up adoption of nature-positive, climate-smart food production

☞ Nearly 40% of global on-farm emissions occur in developed economies, but nature-positive and climate-smart practices have not been adopted widely or quickly enough by farmers.

Climate and health outcomes are the primary challenges facing developed country food systems today. Greater action is urgently needed. Nearly 40% of global on-farm emissions occur in Modernizing and Formalizing (M&F) and Industrialized and Consolidated (I&C) food systems.<sup>258</sup> Meanwhile, countries with these two types of food systems experience median adult obesity rates of over 25% – higher than is found in food systems of any other type.<sup>259</sup> Addressing these challenges will require changes in food production practices (addressed in this section) and concurrent shifts in diets (see section 3.3).

Nature-positive and climate-smart practices have not been adopted widely or quickly enough by farmers, nor is there even a universally accepted

set of best practices to adopt. One-third of global livestock emissions could be eliminated if producers applied the practices of the 10% of producers in their area with the lowest emissions intensities.<sup>260</sup> Opportunities to mitigate the environmental impact of crop production are also largely unrealized. In 2019, Conservation Agriculture practices — a subset of regenerative agriculture practices that emphasize minimal mechanical soil disturbance, permanent soil organic cover and species diversification —<sup>261</sup> were in use on just 12% of cropland globally.<sup>262</sup> These are not only missed opportunities to reduce the climate impact of agriculture; if more widely adopted, regenerative practices could sequester carbon from other industrial activities as well.

The profile on Vietnam illustrated that the key drivers of adoption — the 4As of awareness, advantage, access and affordability — are critical to enabling large-scale behavioural change among farmers in an emerging market context (see Figure 11). Today, no M&F or I&C country has comprehensively scaled-up adoption of climate-smart and nature-positive production practices, but there are examples of success in Canada and New Zealand. In both, the 4As are present, offering important lessons on how to encourage more adoption, faster. Canada's example also reinforces the importance of an innovation ecosystem in driving farmer adoption of new practices.

### Canada: making an economic case for no-till and low-till

As far back as the 1980s, soil health was a growing concern for many stakeholders in the Canadian food system.<sup>263</sup> Conservation tillage,<sup>264</sup> which can produce several economic and environmental benefits including improved soil health, was known but not in wide use. In 1984, a hearing in the Canadian Senate helped focus attention on soil and, over the following decade, farmer associations, equipment and input manufacturing companies, and governments at both federal and provincial levels took actions that increased the economic advantage for farmers in adopting conservation tillage.<sup>265</sup>

Throughout the 1980s and 1990s, local farmer associations funded by farmers and federal and provincial governments spread awareness and provided technical expertise about the new

practices.<sup>266</sup> They helped farmers share information and organized demonstration farms to prove to farmers that conservation tillage meant lower labour and lower inputs for higher yields.<sup>267</sup> The economics for farmers were improved by a combination of reduced input costs, falling interest rates and rising fuel prices (which made traditional tillage more expensive on a relative basis).<sup>268</sup> Equipment companies marketed new equipment, prototyped by entrepreneurial local farmers, that made conservation tillage compatible with mechanical seeding.<sup>269</sup> The federal government provided grants to reduce upfront costs of new equipment.<sup>270</sup> Government and corporate support together with provincial farmer associations created a multiplier effect to sustain and grow adoption over time. This was supplemented by programmes that further improved farmer profit, such as Alberta's 2007 cap-and-trade carbon pricing system, a relatively early example of a soil carbon programme.<sup>271</sup>

Canada's example shows how various actors can coordinate to create the conditions necessary for the large-scale adoption of one regenerative crop practice, conservation tillage (see Figure 12). It also makes clear the disproportionate importance of demonstrating economic advantage to farmers. Other nature-positive practices, such as cover-cropping, have much lower adoption rates — 16% in 2016, versus 82% for conservation tillage — because of less compelling farmer economics.<sup>272, 273, 274, 275</sup> Output markets for cover crops have not been sufficiently attractive, while breaking-even takes longer (three years, versus one year for conservation tillage) and the investment in cover crops is higher (\$150 per hectare, versus \$50 for conservation tillage).<sup>276</sup>

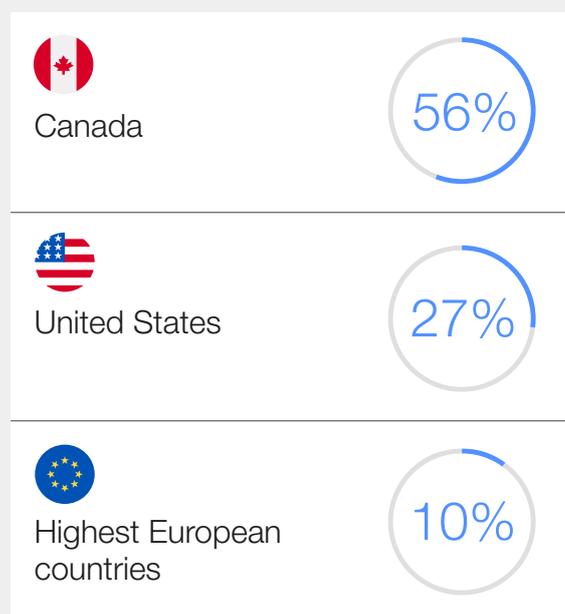
“ By 2016, 82% of Canada's cropland was under conservation tillage, but the adoption rate for cover-cropping was only 16% because of less compelling farmer economics.



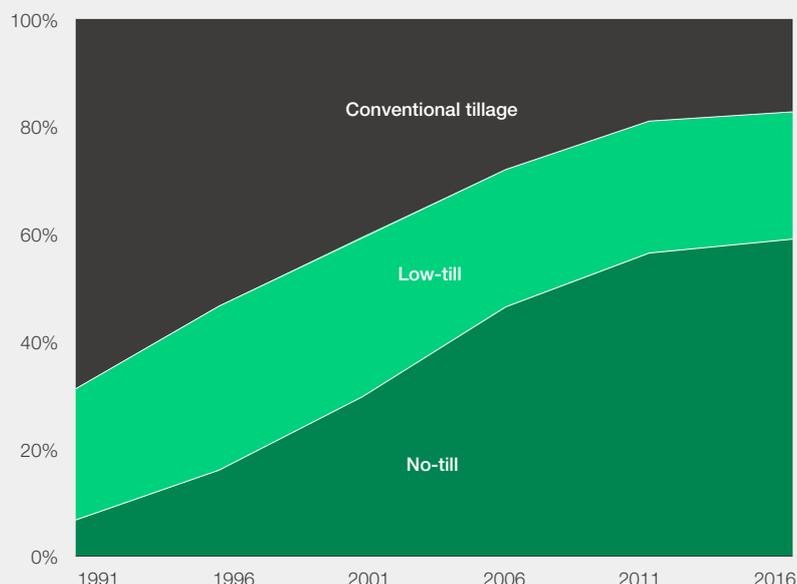
FIGURE 12 | Growth of Conservation Agriculture in Canada

Adoption of Conservation Agriculture practices is higher in Canada than the US or Europe (2019 data)

Canada's adoption of low-till and no-till practices has steadily grown



Percentage of Canadian cropland under specific tillage practices



Sources: FAO,<sup>277</sup> Amir Kassam,<sup>278</sup> Bruce Barker.<sup>279</sup>

### New Zealand: the role of economic incentives in improving livestock farming efficiency and reducing emissions intensity

In the 1980s, following a fiscal crisis, the New Zealand government phased out agricultural subsidies, tax concessions and price supports.<sup>280</sup> Excessive protection of the agricultural sector over many years had resulted in relatively high costs and reduced innovation.<sup>281</sup> To maintain profits in this new economic reality, livestock producers invested in “breeding and feeding” improvements to increase yields, which subsequently improved steadily for three decades.<sup>282, 283, 284, 285</sup>

New Zealand’s experience echoes Canada’s: farmers adopt new practices when given a sufficient economic reason to do so – but there is a second lesson too. Kiwi farmers’ yield-focused investments caused livestock emissions intensity to fall, as production per animal grew faster than emissions per animal. However, although the emissions intensity of livestock production has fallen faster in New Zealand than in any other industrialized and consolidated country since 2000, it still did not fall fast enough to reduce emissions on an absolute basis.<sup>286, 287</sup> If investment in yield alone was not enough to reduce New Zealand’s absolute emissions, it will not be enough to significantly reduce emissions in other advanced livestock

production systems either. Greater effort must therefore be focused on innovative climate-smart practices that will directly address emissions intensity, mitigate climate impact and bend the curve on total GHG emissions.

### Repeatable model to accelerate adoption of climate-smart, nature-positive practices

Countries like Canada and New Zealand will need to reduce GHG emissions from agriculture on an absolute basis to meet global climate targets set out in the Paris Agreement, so while their progress over the last several decades is encouraging, the pace and scale of progress must accelerate. It will be critical to provide farmers with an incremental economic reason, especially in the short term, to invest in climate-smart, nature-positive practices and technologies.

Two pathways – not mutually exclusive – seem most likely to accomplish this:

- Balanced governmental programme of catalytic investment and emissions pricing
- Actions by key corporations and aligned multi-stakeholder coalitions to increase the demand for and, in turn, grow the supply of sustainably produced food

“ It will be critical to provide farmers with an incremental economic reason, especially in the short term, to invest in climate-smart, nature-positive practices and technologies.



The latter pathway will require a new approach to aligned multi-stakeholder collaboration. Both pathways are explored in more detail below.

### **Governmental programme of catalytic investment and emissions pricing**

The US Department of Agriculture's (USDA) Partnerships for Climate-Smart Commodities programme provides grant funding for new business models that make sustainable production of major commodities economically attractive for farmers.<sup>288</sup> The USDA programme is a novel type of catalytic funding that can drive an outsized impact per government dollar by supporting high-potential pilots whose publicized successes can serve as demonstration models for other actors and capital providers, spurring further investments.

In the first two rounds of funding beginning in 2022, the USDA will award up to \$3.1 billion to 141 pilots selected through a competitive process and led by coalitions of corporations and NGOs.<sup>289</sup> For example, a project led by Truterra, a sustainability-focused subsidiary of US co-operative Land O'Lakes, aims to scale-up sustainable production and marketing of grain and dairy commodities via three actions. First, to create economic advantages for farmers through the sale of ecosystem credits and downstream marketing of climate-smart commodities; second, to provide access to digital tools to verify and quantify improvements; and third, to enhance awareness of practices and technical support provided through 50 agriculture retail cooperatives.<sup>290</sup> The effort

comprises a broad coalition of partners including equipment manufacturers, technology companies, financial investors, consumer product companies, biofuel producers, academic institutions and smaller agriculture co-operatives.<sup>291</sup>

Governments have both carrots and sticks at their disposal for spurring action. In New Zealand, the government is planning a farm-level emission levy to begin in 2025, which would make it the first country in the world to put a price on on-farm greenhouse gas emissions from livestock production.<sup>292</sup> Pricing externalities such as GHG emissions can fundamentally reshape the equation for producers and other players further down the value chain, creating an economic case for all producers to shift towards new climate-smart practices. But questions on the policy remain, including how high the tax will be, what actions farmers can take to reduce their tax liability and how the revenue will be used. It is also unclear how the economic impact will be distributed along the livestock value chain and what the effect will be on consumer prices or New Zealand's competitiveness in global markets. Success will depend as well on the ability of government or other pre-competitive collaborations to implement a level playing field for all producers, for example through a uniform emissions cost for all competitors.<sup>293</sup> If producers in New Zealand reduce production due to the levy and that production is replaced by higher-emitting producers in other countries where no emissions levy is in effect, global emissions may not decrease or could even increase.

Though at an early stage, these are examples of bold and innovative action by governments to accelerate progress and should inspire others.

“ Consumer-facing food companies that can differentiate their products based on sustainability attributes and communicate the benefits to consumers can capture additional value and reward upstream producers economically for adopting climate-smart and nature-positive practices.

### Corporations and aligned multi-stakeholder coalitions increase demand for, and grow supply of, sustainably produced food

Corporations can play a critical role by demonstrating economically viable business models for sustainable products and, in doing so, create demand for the agricultural output of climate-smart and nature-positive practices. Consumer-facing food companies that can differentiate their products based on sustainability attributes and communicate the benefits to consumers can capture additional value. And by sharing that value, companies can reward upstream producers for adopting climate-smart and nature-positive practices.

To pass economic value from consumer-facing companies to producers often requires aligned partnerships and coalitions among actors that represent an entire value chain. Three types of companies that own the consumer relationship can play a particularly important role in anchoring these value chain partnerships and coalitions across different types of market structure and commodities:

- **Vertically integrated players.** Companies that span an entire value chain from producer to consumer can more easily distribute the value of sustainable production, compensating for any incremental costs of climate-smart and nature-positive production by capturing new efficiencies internally or by charging modest price premiums for sustainable products.

For example, Dairy Farmers of America, the largest US dairy co-operative, is launching a 13-state pilot programme to commercialize low-carbon dairy. The pilot aims to charge a sustainability premium for low-carbon dairy products, which will help subsidize access for dairy farmers to methane-reducing technologies and technical assistance, including verification of emissions.<sup>294, 295</sup> The pilot is partially funded by a grant from the USDA’s Partnerships for Climate-Smart Commodities programme.

- **Consumer product companies.** These companies can make long-term commitments to suppliers, creating reliable demand that

justifies investment in climate-smart and nature-positive practices with longer payback periods. They can create this demand by switching to regeneratively cultivated ingredients, but they will need to work with upstream partners who already have relationships with farmers to increase supply of these ingredients and pass value to producers. The products easiest to market to consumers as climate-smart will be those comprising of largely one commodity, such as cereals, dairy products or bread. As ingredient lists expand, it can become much more complex, for example, with snack bars or prepared meals. Unilever and General Mills are among several large consumer product companies supporting farmers transitioning to regenerative agriculture practices.<sup>296, 297</sup> In aggregate, large food companies have committed to convert 70 million acres to regenerative agriculture by 2030, an amount equivalent to 18% of US cropland.<sup>298</sup>

- **Retailers.** Retailers provide channels for selling sustainably produced products to consumers. They can therefore play a catalysing role in the redesign of supply chains to meet broader social and environmental goals, especially for unbranded commodities such as fish, meat and private-label products. The Pacific Island Tuna partnership, a joint venture between the Republic of the Marshall Islands and The Nature Conservancy, reinvented the tuna value chain through supplying sustainably caught tuna to Walmart’s “Great Value” private label. The partnership created a new business model that matches robust social and environmental sustainability commitments with best-in-class verification. In addition, the partnership enables Pacific islanders to participate equitably in global tuna supply chains by ensuring compliance with fair labour practices and a greater share of economic value for local communities. Its success required a coalition of partners willing to take risks and work in new ways.<sup>299</sup>



- Bending the curve on absolute GHG emissions from food production will require farmers to rapidly adopt climate-smart, nature-positive practices, like regenerative agriculture – at a much larger scale than to date.
- Farmers will adopt these practices when the 4As of Adoption – awareness, advantage, access and affordability – are in place. The perception and realization of economic advantage is the most critical element.
- Aligned multi-stakeholder partnerships and coalitions involving a wide range of corporate actors, alongside innovative government programmes and investments, can accelerate the transition by creating the right conditions for farmer adoption of new practices and the necessary ecosystems for adoption to scale-up.
- Companies that own the consumer relationship are best positioned to stimulate demand for and pull through supply of sustainably produced foods; they can play a particularly important role in anchoring the multi-stakeholder partnerships and coalitions required.

### 3.3 Towards healthier and more sustainable diets

“Changes in food and beverage consumption patterns in developed countries are critically needed.”

The environmental and health challenges facing food systems in developed countries cannot be resolved by changes in production alone. Consumers in higher-income countries typically choose diets that are too high in foods with large environmental footprints, such as red meat (see Figure 13). Greenhouse gas emissions from food consumption are higher per person in Industrialized and Consolidated countries (see Figure 3) than in any other food system type, even though food production is generally most efficient in these countries. People in these countries also tend to consume more processed foods and beverages with ingredients like sugar that can lead to adverse health effects when over-consumed. On neither challenge have meaningful improvements been observed in developed country food systems. Changes in consumption patterns are critically needed.

Governments have tried to shift diets through a range of policy interventions, with pockets of success. France’s Ensemble Prévenons L’Obésité

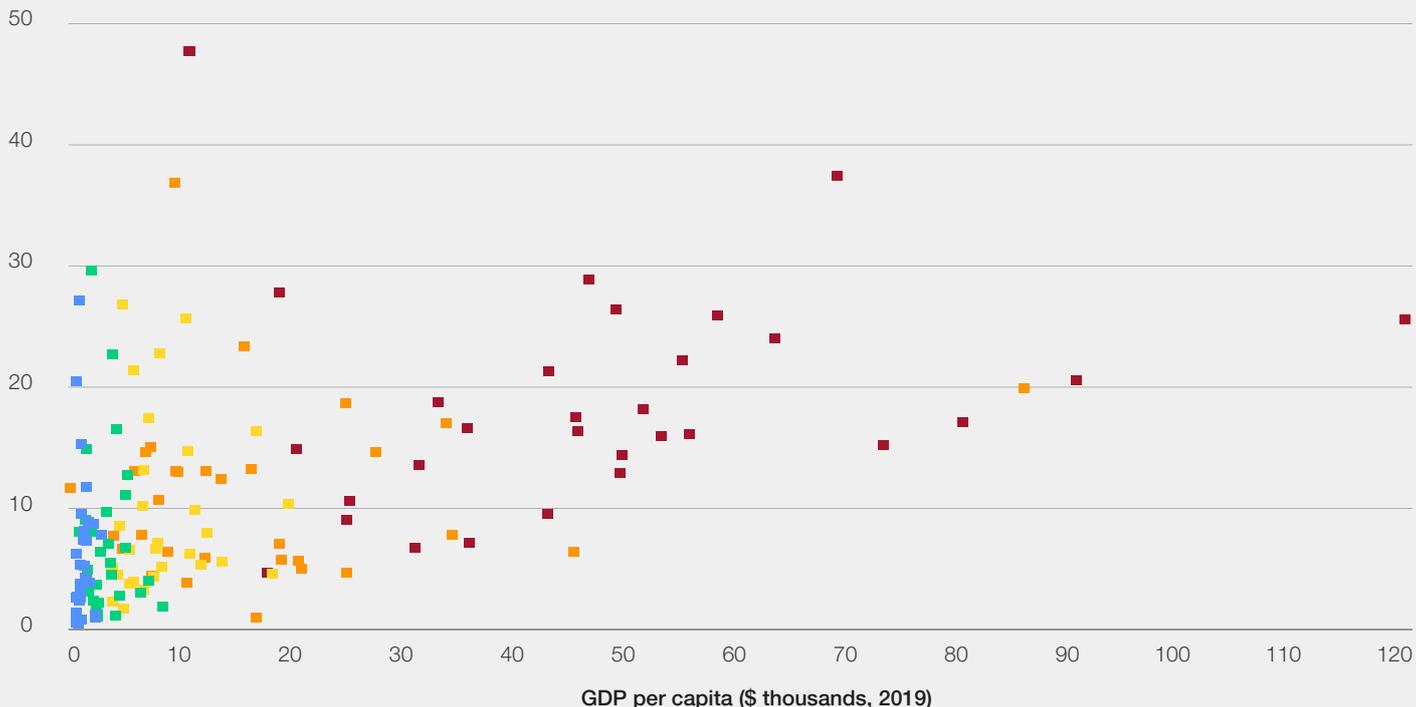
Des Enfants (EPODE or “Together Let’s Prevent Childhood Obesity”) reduced obesity rates by up to 25% in some communities. Community-level integrated programmes modelled after EPODE emphasize local leadership and partnerships to encourage healthier children’s lifestyles through, for example, influencing the availability of healthy food choices, encouraging active travel and leisure, and promoting the use of open spaces.<sup>300</sup> Governments in India, Brazil, the EU and elsewhere limit trans-fats; tax non-staple, pre-packaged foods with high levels of sugar, salt and other ingredients with health risks; and tax the advertising of unhealthy eating.<sup>301, 302</sup>

Still, to date, interventions have not sufficiently changed the trajectories of M&F and I&C countries. In each one of these countries since 2000, obesity rates for adults and children have increased;<sup>303, 304</sup> and while red meat consumption has declined very slightly on a per capita basis (-0.5% per annum), total red meat consumption has not, rising 0.3% per annum.<sup>305</sup>



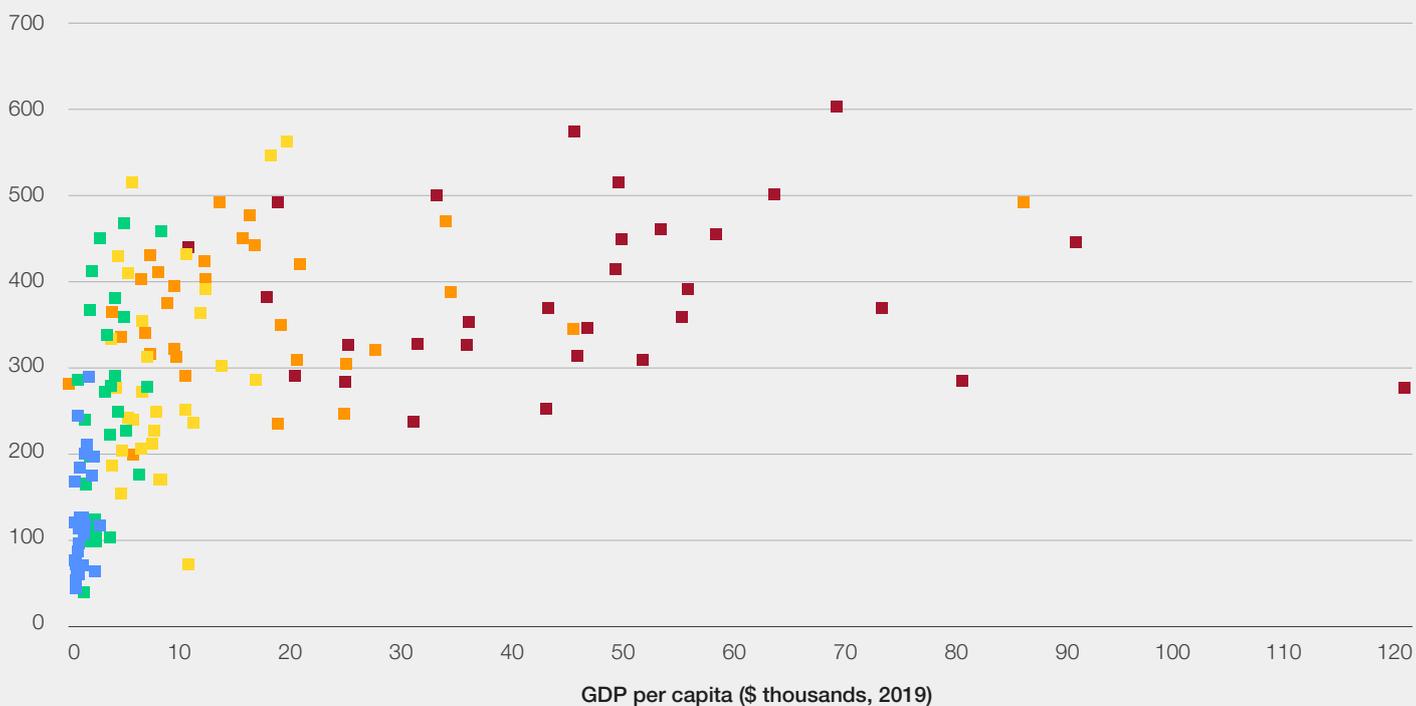
### As incomes increase, people eat more food that has a high impact on the climate and on nature

Beef supply by country (kg/capita, 2019)



### People in higher income countries also eat more food that can have adverse health impacts if over-consumed

Sugar and sweetener supply by country (kg/capita, 2019)



- Rural and Traditional
- Informal and Expanding
- Emerging and Diversifying
- Modernizing and Formalizing
- Industrialized and Consolidated

Sources: FAO, <sup>306</sup> World Bank. <sup>307</sup>

## Model to shift diets and food consumption

Recent Bain & Company research offers hope that consumers, increasingly interested in healthier and more sustainable food, could add critical momentum to these efforts. In surveys of more than 30,000 shoppers across income and age cohorts in 15 countries, respondents in Europe, the US and Asia Pacific said that choosing what is “healthiest

for me and/or my family” is one of the top two purchasing criteria when shopping for groceries. Choosing what is “best for the planet” is often rated highly too, ranking as the third or fourth most important purchasing criterion in Europe and Asia Pacific.<sup>308</sup>

There is a gap, however, between what consumers say they want and what they actually buy. This “say-do” gap is best addressed by three types of action (see Figure 14).

FIGURE 14

### Repeatable model #3: Shifting food consumption patterns towards tipping points to close the consumer say-do gap

 <h4>Pricing</h4> <p>Make healthy and sustainable food choices cheaper and/or make alternatives more expensive</p>	 <h4>Consumer communication</h4> <p>Help consumers determine which products are healthy and sustainable, and understand why</p>	 <h4>Access and availability</h4> <p>Offer more high-quality, healthy and sustainable products in more places</p>
<ul style="list-style-type: none"> <li>– Companies market healthier and more sustainable products to mass market consumers at attractive prices</li> <li>– Governments make less-healthy and less-sustainable products more expensive (e.g. emissions levies, taxes on sugar-sweetened beverages)</li> <li>– Governments or corporates (e.g. health insurers) subsidize healthy and sustainable products</li> </ul>	<ul style="list-style-type: none"> <li>– Companies clearly communicate healthy and sustainable attributes of their products</li> <li>– Pre-competitive industry groups and governments set standards and promote effective labelling</li> <li>– Consumer education programmes (including in schools) raise awareness about healthy, sustainable food</li> </ul>	<ul style="list-style-type: none"> <li>– Corporates re-engineer food products using healthier, more sustainable ingredients, while maintaining taste and quality</li> <li>– Companies and insurgent brands (often backed by venture capital) introduce new, healthy and sustainable products</li> <li>– Cross-sector partnerships kickstart demand for healthy and sustainable indigenous commodities (especially in developing markets)</li> </ul>

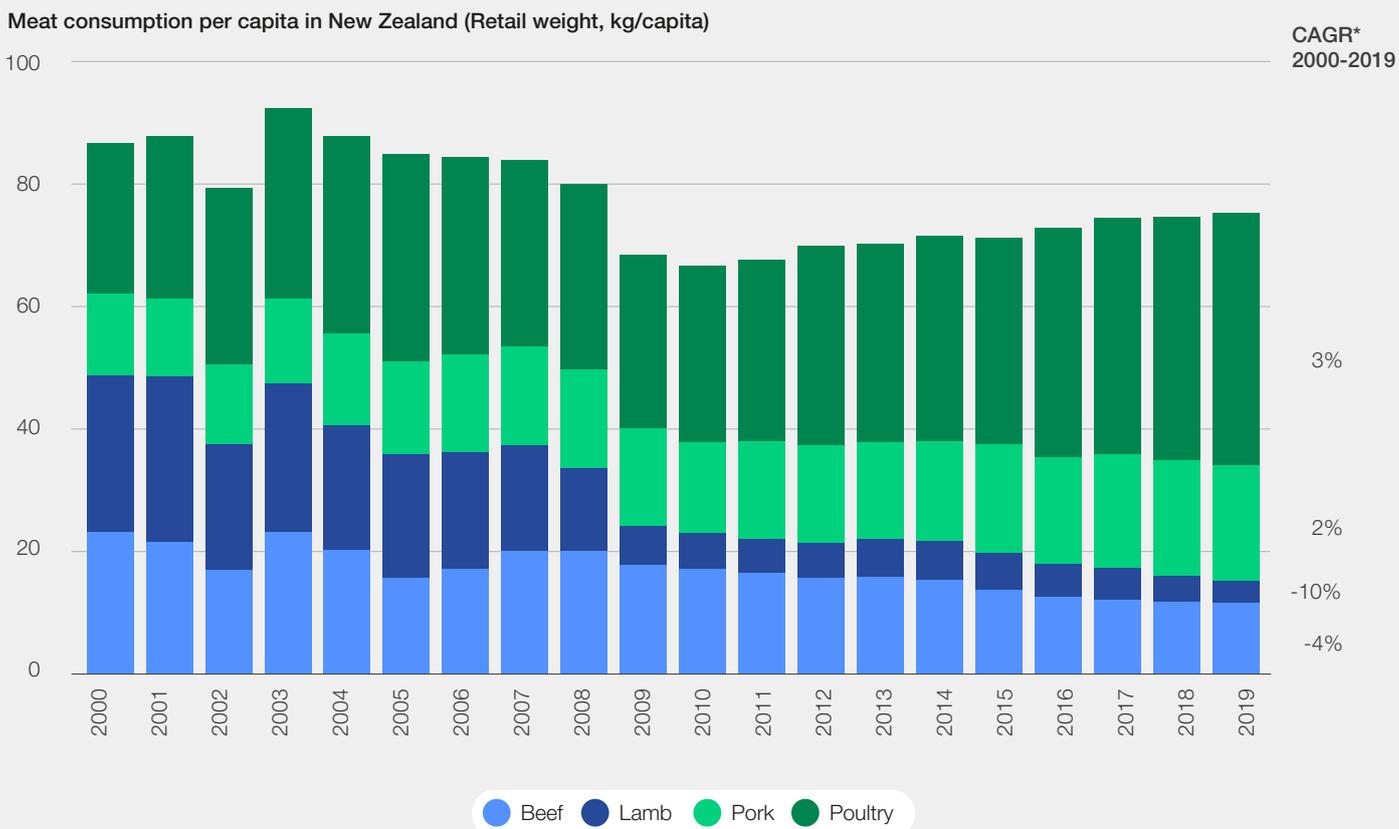
## Pricing

New Zealand’s experience suggests that changes in pricing, even when unplanned, can make consumption patterns more sustainable. In 2000, beef and lamb, both of which have a high GHG

footprint, accounted for more than 55% of the average New Zealander’s meat consumption. By 2019 that share had fallen to 20%, replaced by poultry and pork. Over the same period, poultry and pork became more affordable relative to beef and lamb (see Figure 15).<sup>309, 310</sup>

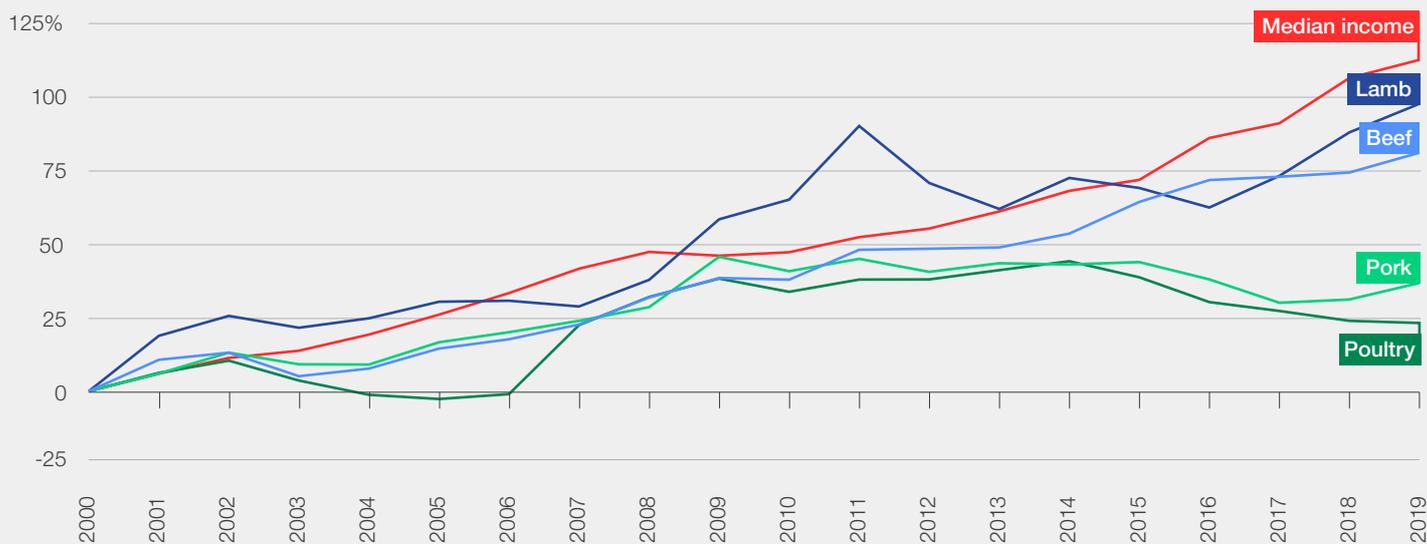


### Beef and sheep share of total meat consumption declined from over 55% to 20% in two decades



### Substitution of beef and lamb for pork and poultry coincided with changes in relative prices

Percentage change in average annual price (\$/kg) and median annual income (\$) in New Zealand, indexed to 2000=0



Sources: StatsNZ,<sup>311</sup> OECD,<sup>312</sup>  
\*Compound annual growth rate (CAGR)



**“ Consumer product companies can accelerate the shift to healthier and more sustainable diets by increasing their efforts to target product innovation towards the mass market.**

The combination of higher animal yields which reduced emissions intensity (section 3.2), and shifts away from red meat consumption to lower GHG-emitting poultry and pork, led to reduced emissions relative to what they would have been if livestock production emissions intensity and consumption mix had not changed since 1990. The abated emissions are valued at somewhere between \$10 and \$40 billion using marginal abatement costs of \$40 to \$150 per metric ton of CO<sub>2</sub>-equivalent.<sup>313, 314</sup>

Many countries have begun taxing unhealthy foods. In 2012, Mexico had the highest intake of sugar-sweetened beverages (SSBs) globally, at 160 litres per person per year.<sup>315</sup> In 2014, the government launched a 1 peso per litre tax on these beverages, which led to a 9.7% reduction in total SSBs purchased over the next two years.<sup>316</sup> A study of 13 cities and countries in North America, Europe, South America and the Middle East showed that taxes had effectively reduced purchases of sugar-sweetened beverages. The World Health Organization recommends the policy.<sup>317, 318</sup>

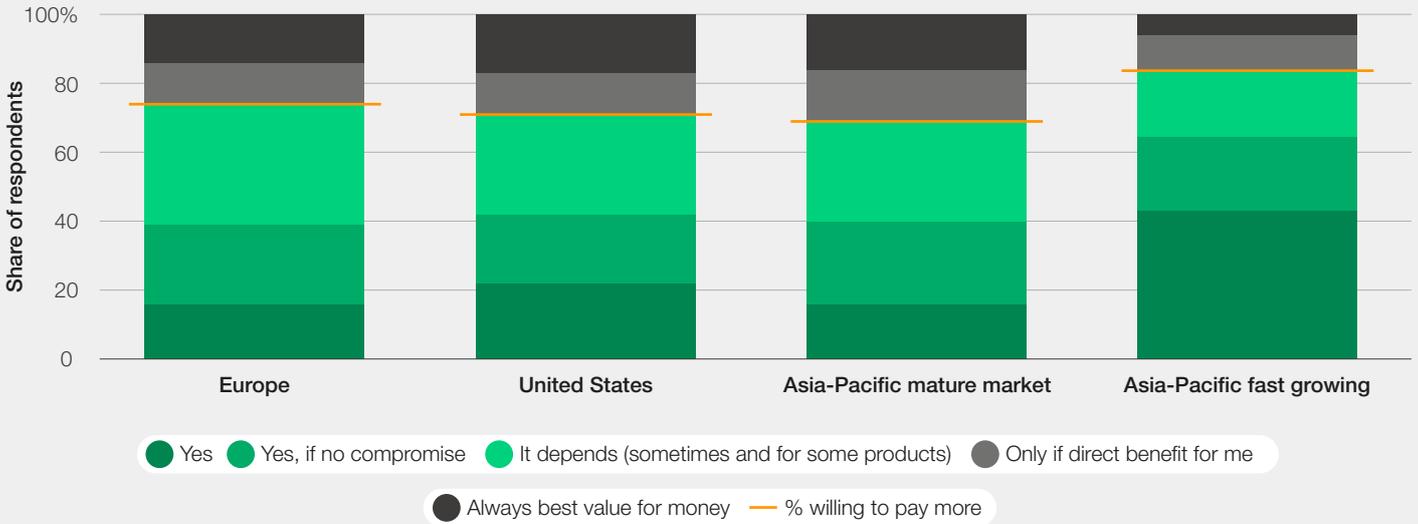
Companies can also be a powerful actor in changing consumer behaviour via pricing. Bain research finds that more than 65% of consumers in Europe, the US and Asia Pacific say they are

willing to pay a premium for sustainable products in at least some cases (see Figure 16).<sup>319</sup> However, that willingness drops significantly when premiums are over 25% – and products marketed as having sustainable attributes often carry a much higher premium than that.<sup>320</sup> One study in 2018 found that sustainably marketed yogurt and fresh bread carried premiums of 45% or more relative to conventionally marketed products.<sup>321</sup> Given consumers’ high willingness to pay modest premiums, consumer product companies can accelerate the shift to healthier and more sustainable diets by increasing their efforts to target innovation and tailor product propositions towards the mass-market and not just premium niches in the market.

The opportunity to shape consumer behaviour is not limited to consumer product companies or retailers. In 2009, South African insurer Discovery began offering cash rebates of 10% to 25% on produce and other healthy purchases made at 400 partner Pick n Pay supermarkets.<sup>322</sup> The company found that the larger the rebate, the greater the shift in consumption; it now offers up to 75% cash back on healthy items at partner grocery stores.<sup>323</sup> Within three years of its launch, 330,000 individuals had enrolled in the programme – about 20% of eligible members at the time.<sup>324</sup>

### Consumers are willing to pay a premium for sustainable products

Q: Are you willing to pay more for a product/brand that is better for the planet and/or treats its employees/suppliers well?



### But a majority of consumers are not willing to pay more than a 25% premium

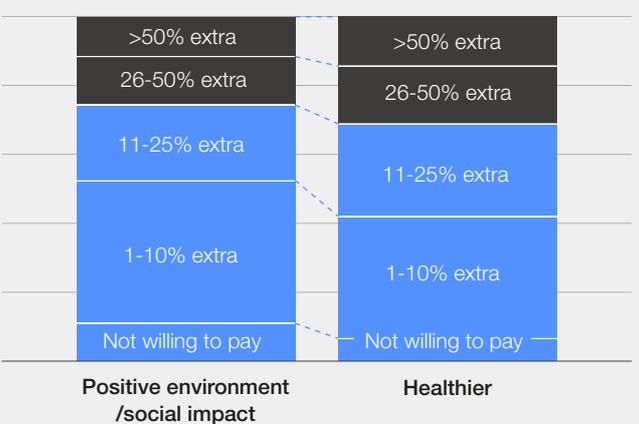
Q: What is the maximum extra price you would be willing to pay for a \*category\* that: a) has positive environmental impact, b) has positive social impact, c) is healthier for you and your family?

US



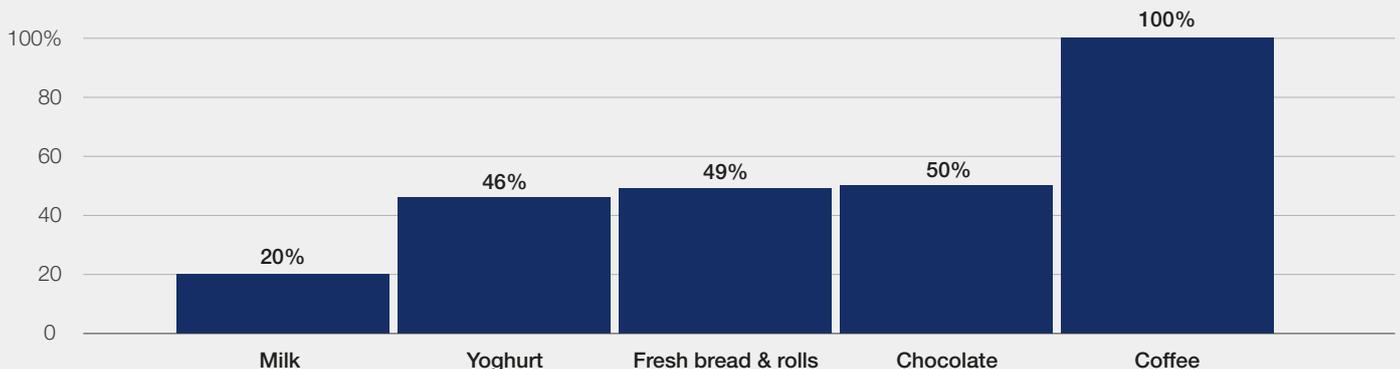
Q: What is the maximum extra price you would be willing to pay for a sustainable \*product\* that: a) has positive environmental/social impact or b) is healthier for you and your family?

Asia-Pacific



### Sustainable products are priced significantly higher

2018 sustainably marketed products' price premium vs. conventionally marketed products in the US



Sources: Bain & Company,<sup>325</sup> New York University,<sup>326</sup>

## Consumer communication

Consumers are often confused about products' health and environmental claims and struggle to understand differences in claims and their implications. When asked to identify which of two common products has the smaller carbon footprint, such as "1 kg of cheese versus 1 kg of milk" or "organic meat versus inorganic vegetables", more than 80% of consumers surveyed across regions by Bain chose incorrectly.<sup>327</sup> Both companies and governments can encourage shifts in consumption by better communicating the health and sustainability properties of foods.

In 2016, Chile's government introduced a mandate that required food labels on the front of packages as part of broader legislation to make diets healthier. As a result, consumption of unhealthy foods decreased. Sales of sugar-sweetened beverages, for example, dropped 24% by the end of 2017 – an even greater decline than that created by Mexico's sugar-sweetened beverage tax.<sup>328</sup> Transparency is critical. Alongside government regulation, companies can collaborate pre-competitively to define common metrics and standards for both health and sustainability. These could provide the basis for creating a small number of simple, universal labels that make health and sustainability claims specific, transparent, credible and comparable across products. In contrast to the value chain-based partnerships discussed in section 3.2, such pre-competitive collaboration works best when it involves many of the key companies operating in a similar part of the value chain.

### Access and availability

In the US, less than one-third (by sales value) of packaged food and beverages are considered healthy.<sup>329</sup> Meanwhile, 43% of surveyed consumers said that better availability — along with lower prices — would prompt them to start buying sustainable products. When consumers do buy more sustainable products, one reason cited is that a wider assortment of those products has become available in the places they shop.<sup>330</sup>

Innovation led by companies and venture capital investors to re-engineer existing products and offer new products at attractive prices can help make healthier and more sustainable options more widely available. The fast growth of alternative protein brands shows how innovative products capable of quickly scaling-up production and distribution can shift consumption, even to an entirely new type of food. The alternative meat category rang up more than \$2 billion in sales in 2020, as distribution of innovative plant-based meat products climbed.<sup>331, 332</sup>

Large consumer product companies have begun to re-engineer products and shift their portfolios to offer healthier and more sustainably produced options. Unilever, for example, intends that 70%

of its portfolio will meet WHO-aligned nutritional standards; in 2022 it announced plans to publicly report the performance of its product portfolio against at least six different government-endorsed nutrient profiles, such as the Europe-wide Nutri Score model, becoming the first global company to do so.<sup>333</sup>

The need for new consumption patterns is not restricted to developed markets. Today, just 12 plant species and five animal species provide three-quarters of the global food supply.<sup>334</sup> For developing countries, where more than 20% of the population may be undernourished, more crop diversity can mean greater resilience for farmers and more nutritious diets for their populations.

In India, a series of government-led efforts have tried to increase millet consumption by investing in public marketing, productivity enhancements, strengthening seed supply and enhancing post-harvest value addition and market linkages.<sup>335</sup> In Odisha, where the production of finger millets has increased almost 15 times since 2017, the Odisha Millets Mission illustrates the potential impact of multi-stakeholder partnerships. There, government agencies increased demand through public procurement and consumer campaigns, while NGOs with ties to agricultural communities implemented the programme and researchers developed higher-yield, more-resilient seed varieties.<sup>336</sup> Recognizing the potential for millets to improve nutrition and increase food supply resilience to climate change, the UN General Assembly declared that 2023 will be the International Year of Millets.<sup>337</sup>

### Collaboration is key

Clearly there are important roles that a wide range of food systems participants can play in moving the world towards healthier, more sustainable consumption. Smart government policies can incentivize the right behaviour. Pre-competitive collaboration can help drive broad industry change. Corporations, entrepreneurs and investors can lead and support innovation.

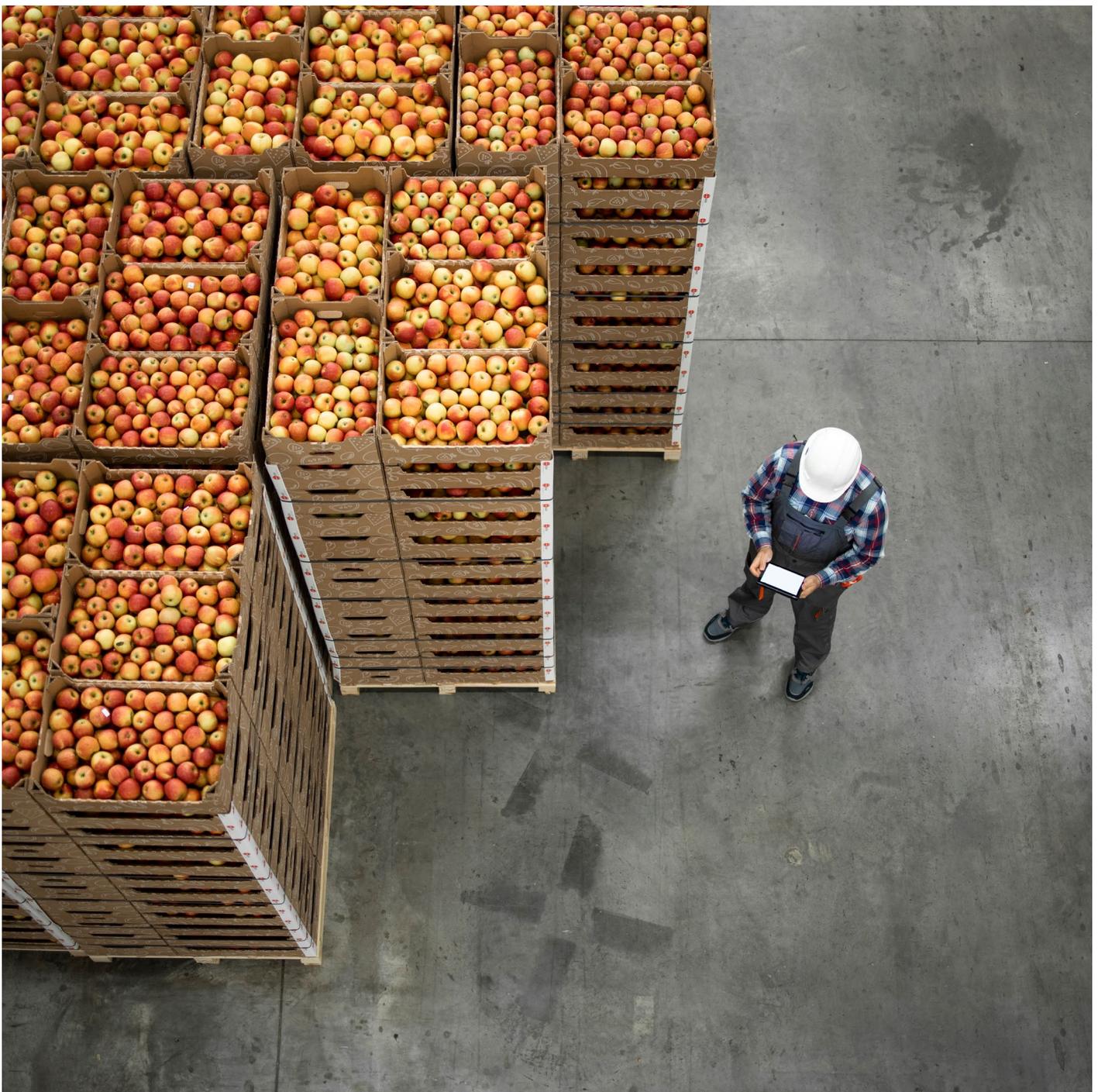
Innovation can hold the key to more balanced and optimal outcomes across multiple food system dimensions. But the adoption of innovative, climate-smart and nature-positive practices and technologies requires robust ecosystems to scale. Similarly, large-scale changes in consumption habits towards more sustainably produced and healthier foods will require concurrent public and private action. In addition, to accelerate true food systems transformation, multi-stakeholder partnerships and coalitions will need to align around shared outcomes, bring complementary perspectives and capabilities, and build innovative demonstration models that can be scaled-up and replicated, such that the change in norms can more quickly reach a tipping point that enables true food systems transformation.

“ Alongside regulation, pre-competitive corporate collaboration can define common metrics, standards and labels that make health and sustainability claims specific, clear, credible and comparable across products.

4

## A roadmap for multi-stakeholder action and investment

Aligned, coordinated multi-stakeholder actions and investments will be necessary to accelerate country-level transition toward more inclusive, sustainable, healthy and resilient food systems.



This report has told the stories of some significant food systems successes – from India’s dairy sector transformation to Vietnam’s scale-up of sustainable rice production and Canada’s widespread adoption of conservation tillage practices. These early mover countries have, to varying degrees, pioneered ways to grow more food, feed more people and build a stronger economy in ways that are more sustainable for the planet.

However, none of these examples reflects a holistic approach to food systems transformation, in which significant progress would be made against all dimensions of food systems outcomes. The early mover profiles in Chapter 2, in particular, were first and foremost agricultural production and economic transformations which improved livelihoods and nutrition security. Nonetheless, the proven approaches illustrated by these example can, if taken together, provide relevant tools,

frameworks and an economic understanding that governments, corporations, entrepreneurs, financiers, donors and NGOs can use to transform food systems across all dimensions.

To accelerate the pace and scale of transformation, countries must pursue the actions and investments discussed in this report in tandem and with greater urgency. This will require unprecedented strategic alignment and coordination among public, private and social sector stakeholders to achieve holistic food systems transformations that are outcome-based. And it will necessitate constant appraisal of the trade-offs and inter-relations of the various dimensions of food systems as well as finding the right balance across complex and diverse agendas.

There are five key areas of action and investment that food systems stakeholders should prioritize (see Figure 17).

FIGURE 17 A roadmap for action



Sources: World Economic Forum, Bain & Company.

## Every country needs to develop and implement an integrated food systems transformation roadmap

The early mover profiles, especially of developing and emerging countries, reinforce the essential role governments play in catalysing food systems transformation through their direct investment, the enabling policy and regulatory environment they create and the manner in which they attract private sector capital. While these transformation successes have led to improvements in a subset of outcomes – including production and economy, livelihoods and food security – governments are starting to embrace a more holistic vision for food systems transformation, with greater emphasis on diet diversity, inclusion, climate action and resilience. The 117 pathways created by governments since the 2021 UN Food Systems Summit are a starting point, but there is a long way to go.<sup>338</sup> Not only do most countries lack an integrated roadmap that addresses all dimensions of food systems transformation, but many don't have the capacity or capability to create one.

The process starts with setting clear targets, both mid- and long-term, for all food system dimensions. Roadmaps must be tailored to those outcomes and the country's specific starting point. They should include the level of public investments, including their relative emphasis and sequencing, as well as policy interventions and use of related tools. This requires a significant degree of inter-ministerial cooperation. Government ministries overseeing food and agriculture, trade and industry, environment and land use protection, consumer health and safety, and finance will need to collaborate on priorities and actively manage the inevitable trade-offs and tensions – while always keeping in mind the true cost (and value) of food for society as a whole.

It is especially important to include long-term public sector commitments and investments underpinning these plans. In Africa, for example, this would mean meeting the CAADP recommendation of spending 10% of government budgets on agriculture and focusing on an integrated food systems transformation across government spending.<sup>339</sup> However, the challenges faced by developing market governments to address climate change, along with the combined effects of the pandemic, inflation and Russia's war in Ukraine, call for more coordinated efforts by international financing institutions to restructure sovereign debt in a way that would complement and support food systems transition.<sup>340</sup> The landmark agreement reached at COP27 on a new Loss and Damage Fund for vulnerable countries is an important step forward. These challenges also reinforce the importance of governments attracting and leveraging private investments.

Public investments will continue to play a critical catalytic role, but the nature of these investments

will need to evolve to support a broader food systems agenda. Physical infrastructure – including roads, public markets, irrigation, electrification and cold chain – remain critical in developing markets; but today, infrastructure investments must more explicitly consider environmental impact and climate-smart options, and they must expand to include digital and data commons, such as geospatial data, soil health mapping and integrated farm-level data. There is human infrastructure too: agricultural extension agents, agronomists and farmer organizations can all play important roles in skilling farmers and changing their behaviour. Technical talent becomes more relevant as technology solutions become more important enablers of transformation.

As countries evolve towards a holistic food systems approach, governments and their investment partners will need to develop a more integrated food systems policy and regulatory framework. They will need tools for a whole range of priorities – to accelerate the adoption of climate-smart and yield-enhancing inputs, practices and technologies; to support small and medium enterprise growth; to shift consumption patterns towards healthier diets; to deter illegal land-use change; and to safeguard natural resources. These tools could include subsidies, taxation, incentives, preferential or subsidized credit access, standards setting and smarter government procurement (e.g. through school and institutional feeding programmes).

The effective development and delivery of such plans require strengthening the transformation capacity of local governments. The breadth and complexity of food systems and the proliferation of development programmes and cross-sector partnerships make this especially important in developing countries. It will likely require development and philanthropic funding to help catalyse more long-term, sustainable financing of this capacity expansion.

Importantly, governments should more proactively pursue public-private partnerships to inform and accelerate their transformation agendas. In this context, the [Food Action Alliance](#) – founded in 2019 by the International Fund for Agricultural Development (IFAD), Rabobank and the World Economic Forum with 40 member institutions – is an innovative, multi-stakeholder platform that aims to facilitate such collaboration. Its work includes mobilizing partnerships and investments towards national government priorities and programmes, and endorsing a growing portfolio of investible flagship food systems transformation initiatives covering a range of countries across Africa, Asia and Latin America.

## Prioritize high-potential, farmer-allied enterprises in transformation plans, programmes and investments

Farmer-allied enterprises, when scaled-up, have the potential to act as anchors for more resilient local food systems, helping deliver better outcomes across multiple food systems dimensions. Governments, funders, corporations and NGOs are smart to focus on them because when these firms are able to scale-up, they can create a virtuous cycle of gains for farmers in terms of productivity, livelihoods and resilience; job creation and GDP growth; more affordable nutrition for consumers; and greater inclusion of youth and women in agricultural economies. In building strong farmer engagement and providing reliable demand, these enterprises can also play an important role in encouraging farmers to adopt climate-smart and nature-positive inputs, practices and technologies.

Successful farmer-allied enterprises are anchored by reliable demand sinks, prioritize efficiencies, for example leveraging technology to minimize post-harvest loss, and are able to achieve the economies of scale that can drive down unit costs. These enterprises are often vertically-integrated and are predominantly found in higher-margin, export-oriented value chains where they can command an economic premium. For lower-margin output markets in cereals, tubers, legumes and domestic fresh fruits and vegetables, another type of farmer-allied model that focuses on aggregation will be essential and deserves more attention and support.

In developing markets, examples of farmer-allied enterprises that have scaled-up successfully remain few and far between, especially in lower margin-food crops that feed local populations. Finding affordable financing and inputs, expertise and talent, and support services in areas like packaging and logistics can all be a battle. Meanwhile, enterprises that intend to be farmer-allied often face higher costs in the near term — because they pay fair market prices and quality premiums, make long-term and high-volume commitments, and facilitate farmer access to inputs, financing and extension services. Greater amounts of better-aligned financing and other support will be required to enable high-potential businesses to grow profitably and transition to more sustainable food systems approaches.

Farmer-allied small- and medium-sized enterprises, when scaled-up, have the potential to anchor food systems transformation in developing and emerging markets, but their relevance is not limited to such markets and farmer-allied behaviours should not be limited to SMEs. Large companies with strong farmer relationships should also design farmer-allied sourcing models. Such an approach would not only deliver equitable economic outcomes for farmers — in turn strengthening their capacity and resilience — but it would also assure the quantity and quality of supply for those companies.

## Coordinate public and private financing and greater amounts of blended capital to unlock capital flows

Many of the early mover examples profiled in this report showed the impact of coordinated public and private financing, and the use of risk-sharing mechanisms such as credit guarantees and interest subsidies to unlock greater amounts of capital to support private enterprise development. These enterprises can help drive economic growth, improve livelihoods, provide more affordable nutrition, and lead innovation in sustainable practices and technologies. Public and private actors should continue to explore greater coordination and collaboration on this front to address a broad set of food systems outcomes.

Blended financing, defined as the use of catalytic capital from public or philanthropic sources to increase private sector investment in sustainable development, can be an important tool in unlocking greater domestic capital for areas of the food system that would otherwise be under-funded because their risk-return balance is unlikely to make standalone commercial sense in the near or even medium term.<sup>341</sup> Areas that need blended financing can include, among others: agri-SMEs

(especially if farmer-allied and operating in low-margin domestic food crop markets); innovative businesses in sustainable agriculture targeting smallholder farmers; and certain areas of climate finance, such as protecting natural resources and supporting smallholder farmers and SMEs in their transition to climate-smart practices. Today, agriculture represents only 15% of global blended finance transactions.<sup>342</sup> According to a recent report by SAFIN and Convergence, allocating 20% of existing agriculture official development assistance (ODA) funds towards blended finance could — with a six-times leverage factor — mobilize an additional \$13 billion annually. This would narrow the sector-specific Sustainable Development Goal (SDG) investment gap in food systems transformation and potentially create a large-scale demonstration and catalytic effect.<sup>343</sup>

Blended finance can be especially relevant when applied at the market and portfolio levels. In developing and emerging markets, providing adequate affordable debt is crucial for the many agri-SMEs that require working capital and capex loans structured with longer payback periods. In

Sub-Saharan Africa alone, the small and medium agri-enterprise debt gap is estimated at \$74.5 billion.<sup>344</sup> The use of blended financing by international donors and funders in these markets should be oriented around strengthening local financial institutions and incentivizing them to grow their agriculture portfolios. Mechanisms such as concessionary lines of credit, credit and first-loss guarantees, interest subsidies, collateral “top-up”, origination and impact-based incentives are all tools to de-risk and improve the economics of lending in a sector that experiences a high level of systemic and firm-level risks and where a significant degree of business model innovation will be required to bring about transformation at scale.

At the portfolio level, where the typically smaller agricultural transactions in developing markets can be aggregated to reach larger investment sizes and risks can be better diversified, first-loss vehicles that blend higher and lower risk-tolerant investment capital are increasingly common and can effectively unlock more patient, impact-oriented capital. There are two areas where such capital is most needed. Small ticket-size, concessionary equity can help unlock affordable debt financing for smaller, asset-intensive enterprises in the hidden middle. Early-stage, innovative models of aggregation and climate-smart technologies aimed at smallholder farmers also require patient, risk-tolerant growth capital. Impact investors are best positioned to anchor these efforts, given their focus on social impact, long payback horizons and low returns expectations.

Coordinating capital and technical assistance can also reduce the overall risk to lenders and investors, attracting more commercial lending and combinations of investors with different risk tolerances. This could take the form of a technical assistance facility (a grant facility to provide for: farmer organization and training in sustainable practices; the building and strengthening of farmer-allied sourcing models; facilitated access to buyers and markets; and the enterprises’ own strategy

and business planning, financial management and technical expertise) structured alongside an investment and/or debt vehicle. Beyond its role in financial de-risking, this type of support can promote the pipeline development of bankable and investible agri-SMEs, and reduce the origination and transaction costs associated with information asymmetry – as such it should be prioritized by international donors and institutional foundations.

Agriculture-related climate financing, which only accounts for a limited number of blended finance transactions, is an important area for growth in blended financing and will be critical to unlocking investments in climate change mitigation and adaptation in developing countries.<sup>345</sup> Such financing will enable smallholder farmers to adopt productivity-enhancing and climate-smart inputs, practices and technologies. It will support the greening of supply chains, including cold chains, processing operations and packaging options. And it will help to scale-up innovative circularity mechanisms and waste reuse businesses, such as biogas from captured methane and organic fertilizers. There are also opportunities to diversify revenue streams and mitigate investment risks by developing new mechanisms for certifying, aggregating and monetizing emissions reductions, and by linking agriculture to financing for landscape approaches such as forest conservation.

Finally, it is important to note that corporations — both in their investments and by anchoring demand sinks — are crucial value chain actors that directly or indirectly enable financial flows, particularly towards agri-SMEs and smallholder farmers. By enabling agri-SMEs to scale-up and encouraging their farmer suppliers to grow production and adopt more sustainable inputs, practices and technologies, corporations should be viewed as a key enabler of successful blended financing mechanisms.

## Scale-up change faster through technology and innovation ecosystems

Our ability to change behaviour, particularly farmer behaviour, in eight years rather than 20 depends on much quicker adoption of innovation at scale. To do so, we need to strengthen innovation ecosystems that are farmer-focused and aligned with government priorities, interventions and incentives.

There has been an explosion of innovations in the food and agriculture space in the last decade, with many leveraging the latest technologies. These include platforms for digital farmer services and supply chain solutions that use artificial intelligence, machine learning, remote sensors, satellites and blockchain; methane-inhibiting feed additives; green fertilizers; vertical farming; autonomous vehicles, robotics and drones; bio-stimulants; and biological crop protection. Such innovations aim to help farmers improve their productivity and reduce

food loss, while minimizing and mitigating climate impacts and pressure on natural resources.

In developing markets, entrepreneurial innovation — often supported by impact capital — has resulted in advances including solar-powered micro-drip irrigation; mobile chillers and storage; biogas; digital learning and advisory platforms for soil, weather and pest management; and even tractors that convert crop residue to mulch while seeding at the same time. New and more diverse crop choices and seed varieties could help farmers adapt to climate impacts and become more resilient. Innovations can also involve relatively low-tech practices applied in new locations and even traditional practices and Indigenous knowledge applied in a modern way.

Innovation in financing is needed too. Carbon credit schemes, for example, can encourage adoption of climate-smart practices while providing a new revenue stream for farmers. Insurance mechanisms can facilitate the transition to regenerative practices by mitigating the risks of yield reductions in the near term.

The biggest challenge is not so much a lack of innovation, but working out how to quickly achieve large-scale adoption. More attention must be placed on building country-level and regional ecosystems and food innovation hubs that make this possible. Such an approach would best allow countries that are seeking to address outcomes seemingly in tension – such as improving livelihoods and feeding more people, while reducing climate and nature impacts – to balance these challenges more effectively and swiftly than has been the case in many developed markets.

Building innovation ecosystems that provide the necessary economic incentives, financing, tools, inputs, knowledge and other support to accelerate the adoption of innovation will require new collaboration models for government, private and social sectors. The World Economic Forum's [Food Innovation Hubs](#) are an example of a multi-

stakeholder partnership platform that supports the scaling-up and adoption of technologies and broader innovations for climate-smart and resilient food systems, by unlocking public-private investments in support of national strategies. In building high-impact innovation ecosystems, the following elements require stronger emphasis:

- **Farmer-centricity:** Multiple stakeholders must be aligned to deliver on the 4As of farmer adoption, especially advantage and affordability (see Figure 11 for additional detail about the 4As)
- **Government alignment:** Innovations have a higher likelihood of success when aligned with government transformation priorities and when the government can help finance them with tax credits, subsidies, preferential lending and other tools
- **Farmer-allied enterprise enablement:** Farmer-allied enterprises can play a key role as trusted intermediaries and reduce farmer risk concerns through offtake agreements and potentially pricing premiums

## Mobilize the next generation of action-oriented, multi-stakeholder partnerships and coalitions

Transforming food systems at speed and scale requires a new approach to public-private and multi-stakeholder collaboration. A key purpose of such collaboration is to demonstrate what is possible and the market applicability of new solutions. These demonstration models of collaboration can then be scaled-up by harnessing the power of multi-stakeholder leadership, government policy, financing, technology and pre-competitive platforms – multipliers that can accelerate the replication of models towards a tipping point that changes the norms of food systems interactions.

In developing markets, where such collaboration is especially critical due to systemic challenges, successful value chain-based partnerships have long been established for origin-specific, export-oriented cash crops such as coffee and tea, along with local sourcing for high-margin consumer packaged goods such as beer. Similar value chain-based partnerships are now needed in lower-margin food crops, in export commodities that have significant negative environmental impacts, and in developed markets where consumption must shift and food must be produced in low-carbon ways.

An emerging set of such partnerships illuminate the critical attributes that make these collaborations work:

- **Aligned on outcomes:** Strong alignment is needed between all partners on an integrated set of targeted food systems outcomes.
- **Right partners at the table:** These should include relevant upstream, midstream and downstream players; social and public actors who can facilitate connections and provide support to farmers and local SME suppliers, while safeguarding environmental interests; and broader ecosystem players that can provide innovative mechanisms to enable the transition (e.g. insurance companies, ecosystem services providers).
- **Relevant pilot projects:** Pilots should be place-based or context-specific, with clear, right-sized geographic and value-chain or food-basket priorities.
- **Strong commitment and engagement:** Especially from large companies that own the consumer relationship and can create demand by shaping the consumer proposition. Such companies can expand the economic margin within supply chains and provide the volume commitments needed to incentivize all their suppliers — including aggregators, processors and ultimately the farmers — to source and grow food differently.

Beyond innovations in value-chain based partnerships, we need to develop the next generation of pre-competitive platform collaborations to improve the inclusivity and sustainability of commodity supply chains, by establishing collectively – and at scale – leadership ambition, common frameworks and certification standards. Examples and priorities include the following:

- The [Global Dairy Platform](#) is setting standards on climate-smart and inclusive practices, as well as leading research and mobilizing partnerships on its Pathways to Dairy Net Zero initiative.<sup>346</sup>
- At COP 26, 13 of the world’s largest agricultural commodity companies committed to delivering a “roadmap for enhanced supply chain action consistent with a 1.5 degrees Celsius pathway”, as set out by the Paris Agreement.<sup>347</sup>
- In the same way that the World Economic Forum’s [Alliance of CEO Climate Leaders](#) has acted as a catalyst for the net-zero transition, new networks and platforms will be needed to build understanding of the approach necessary to integrate food, health, climate, nature and the economy, as well as coordinate actions and investments.
- Similar to the Forum’s [First Movers Coalition](#) for hard-to-abate sectors, there is an opportunity for a first movers coalition of agri-food companies and retailers to provide a significant combined set of demand and supply signals to mobilize a quicker food systems transition.

- Platforms can collaborate with governments to leverage food-related procurement policies and strengthen common labelling standards that more clearly communicate to the consumer a product’s nutrition benefits and environmental footprint.

Delivering on the full potential of public-private and multi-stakeholder coordination and collaboration will be key to accelerating the transition towards better food systems. However, the actual implementation of such coordination and collaboration can be fraught with challenges. Organizational interests and narrow sectoral priorities could make it hard to align around shared goals and approaches. Efforts can be duplicative or disconnected. Bold commitments, while well intended, may fall short in practice. Partnerships, even when launched, can be hard to sustain or fail to deliver intended results. Progress can come down to individuals within institutions who are willing to take risks, facilitate difficult decisions, and find new ways of doing things and working with others. Delivering the roadmap laid out in this chapter will require strengthening the capacity of a broad set of stakeholders — at individual, institutional and country levels — to understand, assess and manage the trade-offs involved in complex food systems transformations, and to navigate and build coalitions around possible change.

If countries can set clear ambitions and create integrated transformation roadmaps that are tailored to their contexts – and if all key food systems stakeholders can more effectively coordinate their actions and investments – then the future looks bright for a global transition towards more inclusive, sustainable, healthy and resilient food systems.



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# Endnotes

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