



Barilla
Center
FOR FOOD
& NUTRITION

FIXING FOOD 2018

BEST PRACTICES TOWARDS THE SUSTAINABLE DEVELOPMENT GOALS



Written by

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Economist

INTELLIGENCE
UNIT

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ABOUT THIS REPORT

Fixing food 2018: best practices towards the sustainable development goals investigates best practices in food sustainability across the world. It uses the three pillars—sustainable agriculture, nutritional challenges, and food loss and waste—of the Food Sustainability Index (FSI), developed by The Economist Intelligence Unit with the Barilla Center for Food & Nutrition, as a framework. Now in its third iteration, the FSI has been extended to 67 countries in 2018 (up from 34 in the 2017 edition).

The Economist Intelligence Unit wishes to thank the following experts, who kindly agreed to participate in the interview programme for this report:

- **Alfred Aziz**, chief, nutrition regulations and standards division, Health Canada
- **Soumya Balasubramanya**, senior researcher, environmental and development economics, CGIAR
- **Andrei Belyi**, vice-president for Latin America and the Caribbean, TechnoServe
- **Carrie Brownstein**, global seafood quality standards co-ordinator, Whole Foods Market
- **Ertharin Cousin**, distinguished fellow of global agriculture, Chicago Council on Global Affairs
- **Sean de Cleene**, head of food security, World Economic Forum
- **Michelle Deugd**, director of agriculture, Rainforest Alliance⁶⁷
- **Kevin Duffy**, co-founder, Winnow
- **Shenggen Fan**, director-general, International Food Policy Research Institute
- **Hasan Hutchinson**, director-general, Office of Nutrition Policy and Programs, Health Canada
- **Samir Ibrahim**, co-founder, SunCulture
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- **Eric Olson**, senior vice-president, Business for Social Responsibility
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- **Kirsten Tobey**, co-founder, Revolution Foods
- **Solitaire Townsend**, co-founder, Futerra
- **Sally Uren**, chief executive, Forum for the Future
- **Fokko Wientjes**, vice-president of nutrition in emerging markets and food systems transformation, DSM

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EXECUTIVE SUMMARY

In October 2018 a new report from the UN's Intergovernmental Panel on Climate Change issued alarming news: the world will feel the effects of climate change far sooner than was once thought, and in order to limit global warming and avoid its negative effects, there is a need for “rapid far-reaching and unprecedented changes in all aspects of society”.¹ With estimates that agricultural activities account for up to 30% of global greenhouse gas (GHG) emissions, the actions needed include addressing the sustainability of the global food system.

As this report shows, most agree that this must be done while feeding an increasingly hungry world. The task looks daunting. While progress has been made in recent years on combating extreme hunger, a growing global population will mean meeting rising demand for food. And as emerging markets become more affluent, demand for higher-quality, resource-intensive foods is increasing too. Meanwhile, nutritional challenges range from tackling obesity to reducing malnutrition and poor access to vitamins and minerals.

To assess the challenges and highlight solutions and best practices, this report incorporates the latest findings from the Food Sustainability Index (FSI). Using the three pillars of nutrition, sustainable agriculture, and food loss and waste, the index provides a tool that can shed light on the progress countries are making on the path to a more sustainable food system. The indicators measured by the FSI can also highlight how food sustainability can help to meet the UN Sustainable Development Goals (SDGs) and the objectives of the Paris Agreement to combat climate change and accelerate moves to a low-carbon future.

When it comes to **nutritional challenges**, policymakers, companies, health authorities and other stakeholders need to address a complex range of challenges. On the one hand, malnutrition and a lack of



access to sufficient vitamins and minerals remains a problem. On the other, poor diets have led to a global obesity epidemic with health consequences such as a rise in the incidence of diabetes.

Policies and best practices range from the development of eating guidelines to the imposition of taxes that discourage unhealthy consumption patterns and new educational programmes. Market forces could play a role in improving global nutrition, too. There is evidence of a rise in demand for healthy, sustainable foods. This is encouraging both start-ups and established companies to seize the opportunities to expand their markets by developing new healthy and sustainable food products to meet this new demand.

¹ IPCC 2018, press release, http://www.ipcc.ch/pdf/session48/pr_181008_P48_spm_en.pdf



When it comes to **sustainable agriculture**, the challenge will be to reduce losses and minimise the environmental footprint of food production, while producing nutritious and sustainable food for all. From the manufacture of chemical fertilisers and pesticides to the irrigation of fields and livestock husbandry, food production takes a heavy toll on the environment. Its impacts include the emission of GHGs, the consumption of water, and the pollution and degradation of soil and land.

Best practices include “sustainable intensification”, which entails finding ways of increasing agricultural yields while conserving natural resources and reducing pollution and the emission of GHGs.

New technologies such as soil sensors and satellite monitoring can help, enabling resources to be used more efficiently through precision farming.

However, there is a growing recognition that traditional farming and the practices found in agroecology also have great potential. These practices are particularly relevant given the world’s reliance on smallholder farmers, who produce 70% of the world’s food and often need help in generating sufficient yields to earn a living while adopting more sustainable farming practices.

Given that enough food is already being produced to feed the global population, a critical tool in the sustainable expansion of food availability will be addressing **food loss and waste**. Vast amounts of food are wasted globally, through the loss of fresh produce and crops before they reach markets and through the food thrown away by consumers.

Solutions include investment in transport infrastructure and better storage facilities as well as training for farmers in best practices in harvesting and storing crops. Digital technologies are helping to connect more efficiently those selling agricultural produce with buyers. And in consumer markets, everything from more effective food labelling to awareness-raising education programmes and food donations is being used to prevent edible food from going to waste.

In this report—reflecting the three pillars of the FSI—Chapter 1 discusses nutritional challenges and their solutions, Chapter 2 examines the best practices needed to reach a sustainable agricultural system and Chapter 3 addresses food loss and waste. Yet what emerges from the research is that all three are closely interlinked, calling for holistic solutions and best practices, joined-up thinking and collaboration by those working at every stage in the global food chain.

INTRODUCTION

When thinking about the global food system it is hard to overestimate one thing: food's complexity. Food is a fundamental need and a right. It is also a commodity, a product, a meal, a source of nutrition—and it is fundamentally linked to questions of culture, heritage, identity and integration. The ability of people to feed themselves with dignity is a long-standing international human right to which many countries are committed. At every stage along the food value chain, farmers, manufacturers, buyers, packagers, distributors, regulators and consumers play a role in shaping its safety and quality, its environmental footprint and its ability to feed the world healthily and sustainably.

Similarly, best practice in food sustainability encompasses many activities, from water conservation to maintaining soil health, the promotion of biodiversity and better yields and incomes for smallholder farmers, and improving nutrition through school feed programmes or the establishment of urban food policy councils. Climate change adaptation and mitigation strategies will be essential in creating a more sustainable food system since agricultural activities make a significant contribution to climate change, accounting for up to 30% of global greenhouse gas (GHG) emissions, according to some estimates.²

Water conservation is also critical since agriculture is responsible for 70% of global freshwater withdrawals.³ Some countries facing severe water scarcity have made efforts to lower their water footprint, according to the FSI's water footprint of crop and livestock metric: these data show some of the world's driest countries, including Malta, Jordan,

Israel and Lebanon, are also those with the smallest agricultural water footprint.⁴ When it comes to the sustainability of water withdrawals, countries that score highly are mainly rich European ones, although several emerging economies also get strong marks, including Brazil, Cameroon, Colombia, Cote d'Ivoire, Mozambique, Rwanda, Sierra Leone, Uganda and Zambia.

Best practice in sustainable food production also involves efforts to eradicate worst practices. These include overuse of chemical fertilisers and pesticides and of antibiotics in meat production, deforestation to make way for farmland, mono cropping (growing a single type of crop every year on the same land) and the cultivation of water-intensive agricultural commodities, such as rice, in areas that are already water stressed.

While challenges such as water conservation, food waste and carbon reduction can be addressed individually, the complexity of the food system requires a multi-sectoral approach that engages actors from government agencies to the private sector, academia and international organisations.

Sean de Cleene, head of food security at the World Economic Forum (WEF), argues that while the annual Conference of the Parties and the 2015 Paris Agreement have brought different sectors together to address climate change, similar processes need

² IAEA, Greenhouse gas reduction, <https://www.iaea.org/topics/greenhouse-gas-reduction>

³ FAO AQUASTAT, Did you know...?, <http://www.fao.org/nr/water/aquastat/didyouknow/index2.stm>

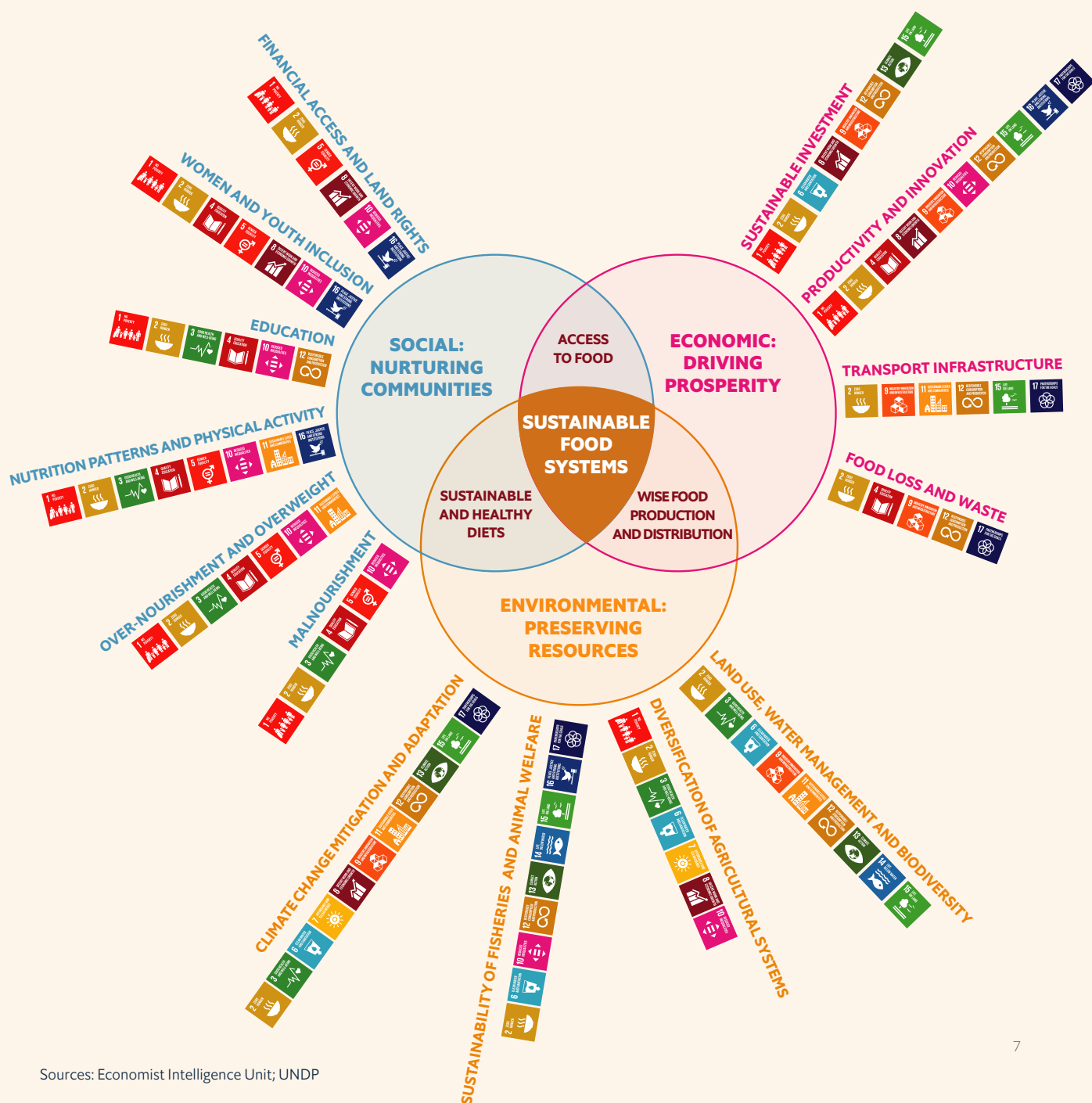
⁴ Mekonnen & Hoestra, National Water Footprint Accounts (2011)

FOOD SUSTAINABILITY: KEY TO REACH SUSTAINABLE DEVELOPMENT GOALS

Food is a common thread linking all 17 UN Sustainable Development Goals (SDGs), given the interconnected economic, social and environmental dimensions of food systems. The Food Sustainability Index (FSI), developed by The Economist Intelligence Unit with the Barilla Center for Food & Nutrition, is a quantitative and qualitative benchmarking model gauging the sustainability of food systems globally across three key dimensions (environmental, societal and economic). The FSI includes three pillars: food loss and waste; sustainable agriculture; and nutritional challenges. The infographic below depicts the economic, social and environmental dimensions of the key food-system indicators included in the FSI. This can highlight the impact of food systems on the 2030 agenda to meet the SDGs.

The FSI allows for comparison between countries and food-system indicators, highlighting best practices that food-system stakeholders—including policymakers, civil society organisations, the private sector, academia and research, and the media—can use to design roadmaps toward more sustainable food systems and ultimately the SDGs. Important drivers of sustainable food systems include education, advocacy and policies.

The composing indicators can be mapped very closely to the various SDGs, as visualised below. The associated SDGs are the ones we think are the most closely linked to each category, but it is not an exhaustive list and the links between food systems and the SDGs remain subject to further study. To explore the FSI, please visit <http://foodsustainability.eiu.com/>.



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to be put in place to promote food sustainability. “The food system itself has to act as a system,” he says. “That means creating alignment and the framework in which a more holistic approach can be taken.”

FOOD AND SUSTAINABLE DEVELOPMENT

One framework that has helped bring together different players in the food system was created in 2015. The SDGs—the result of a wide-ranging consultation process that involved surveys, presentations, working groups and meetings with businesses—set objectives on a number of global challenges that require urgent action, from zero hunger (SDG 2), which includes addressing nutritional challenges worldwide, and health and wellbeing (SDG 3), to climate action (SDG 13), life below water (SDG 14) and life on land (SDG 15).

There are strong connections between the SDGs and the three core dimensions of food systems: economic, social and environmental (see infographic). In fact, some argue that addressing challenges to the global food system should be at the very heart of efforts to achieve the SDGs and the Paris Agreement. “It’s all very much linked,” says Ertharin Cousin, distinguished fellow of global agriculture at the Chicago Council on Global Affairs. “If we do not address the challenges of a broken food system, we won’t achieve any form of planetary health or human health.”

Recognition of the food system’s pivotal role in sustainability has taken some time to materialise. For many years, policymakers often overlooked the connection between climate change and global food systems.⁵ Varying national priorities have made it difficult to reach consensus on the best ways to

promote sustainable agricultural production and distribution, increase resilience to extreme weather events and reduce the carbon emissions that agriculture generates.⁶

Nevertheless, in recent years food has moved to the centre of discussions about global sustainability. First, the rise in severe weather events such as floods and droughts—which have a direct impact on agriculture—has pushed climate change up the agenda. In addition, the link between climate change, food and development is becoming clear. In Latin America, for example, warmer temperatures contribute to the spread of leaf rust, a fungus that devastates coffee plantations. Leaf rust destroys more than coffee. In El Salvador, where some 25,000 families are involved in coffee production, 50-70% of the crop was lost to leaf rust during the 2012-14 season, says Andrei Belyi, vice-president for Latin America and the Caribbean at TechnoServe, an international development non-profit. “With little or no money to invest or access to capital, they’re forced to abandon their farms and move to the city or emigrate.”

As policymakers, non-governmental organisations (NGOs), scientists, the private sector, the media and other food-system stakeholders consider how to move towards a sustainable global food system, they are seeking new sources of innovation and identifying best practices.

In agriculture, for example, emerging best practices include measures such as low tillage, reduced use of pesticides and fertilisers, and water conservation. The goal is to increase productivity, while conserving natural resources and reducing carbon emissions or sequestering carbon through soil management strategies. Meanwhile, agroecology, which taps into traditional agricultural knowledge and practices, plays an important role in sustainable farming by harnessing local ecosystems.⁷

Across many countries, the SDGs are creating

⁵ Inside Climate News, 2017: Agriculture Begins to Tackle Its Role in Climate Change, <https://insideclimatenews.org/news/03012017/agriculture-climate-change-paris-agreement-global-warming-drought>

⁶ CGIAR, A step forward for agriculture at the UN climate talks – Koronivia Joint Work on Agriculture, <https://ccafs.cgiar.org/blog/step-forward-agriculture-un-climate-talks-%E2%80%93-koronivia-joint-work-agriculture#.WtNmkg18c>

⁷ FAO, Agroecology Knowledge Hub, <http://www.fao.org/agroecology/en/>; and AgroEcology Fund, What is Agroecology?, <https://www.agroecologyfund.org/what-is-agroecology/>

frameworks for action. “There are more and more corporate sector partners with their own sustainability programmes,” says Michelle Deugd, director of agriculture at the Rainforest Alliance. “And they frequently base them on the Sustainable Development Goals—that’s an interesting approach.”

Successful initiatives need to adapt to local conditions and tackle worst practices such as the clearance of forests to make way for farmland. “Addressing deforestation is really important in countries from Brazil to Ghana and Indonesia—everywhere where there are big agricultural frontiers moving forward,” says Ms Deugd. “In some countries, it’s about elimination of pesticides, whereas in other countries it can be soil and water management.”

However, changes to farming systems do not always come without trade-offs. For example, solar power can transform livelihoods for smallholder farmers by providing free electricity, which enables them to tap into groundwater for irrigation. “There’s been a huge expansion in solar irrigation, especially in India,” says Sri Lanka-based Soumya Balasubramanya, senior researcher in environmental and development economics at the International Water Management Institute at CGIAR, the international research institute formerly known as the Consultative Group for International Agricultural Research. “But there’s a trade-off. In the longer term, you’re going to have a problem of groundwater depletion.”

Managing these trade-offs—many of which have not yet been considered, says Ms Balasubramanya—must therefore also be a consideration when developing projects that are designed to promote sustainable agriculture. This means taking an integrated approach that looks beyond, for example, how to irrigate a field to the overall management of water in agriculture.

MULTI-STAKEHOLDER APPROACHES

In some areas, industry and government play the biggest roles. In tackling food waste, for example, best practices focus on developing the cold storage, transport infrastructure and market access needed to reduce the amount of agricultural commodities that are wasted post-harvest, particularly in developing countries. For example, 40% of staple foods in sub-Saharan Africa fail to reach markets.⁸

Yet when it comes to food waste, educating the consumer is also critical, particularly in industrialised countries, where food thrown away by consumers is the biggest source of food waste. FSI research by The Economist Intelligence Unit, based on data from the UN’s Food and Agriculture Organisation (FAO), shows annual food waste per head at 95.1kg in the US, the highest of all countries in the index, followed by other rich countries such as Belgium (87.1kg) and Canada (78.2kg); African countries are at the other end of the spectrum, led by Rwanda (1kg) and Mozambique (1.2kg).

This high level of waste has prompted these countries to take action, as the FSI reflects. The US ranks first in terms of the quality of its policy response to food waste, while Spain, France and Italy are also in the top five.

While Japan falls behind other high-income countries in addressing food waste, the country is taking innovative measures to drive progress. To address consumer food waste, in 2013 the Japanese government launched the No-Foodloss Project, a national plan aiming to reform the behaviour of food producers and consumers and adopt loss reduction models in every step of the food supply chain where loss is generated.⁹

⁸ Yieldwise, <https://www.rockefellerfoundation.org/our-work/initiatives/yieldwise/>

⁹ FAO, The No-Foodloss Project in Japan, <http://www.fao.org/save-food/news-and-multimedia/news/news-details/en/c/242644/>

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And, in Spain, the More food, less waste strategy, also launched in 2013, recognises the need for a multi-stakeholder approach to food-waste reduction, whether in raising awareness, developing new technologies or designing regulatory frameworks.¹⁰

As far as nutritional challenges are concerned, best practices might be found in smart regulation, whether that means educating consumers on healthy eating, discouraging unhealthy consumption patterns or requiring foods to contain certain vitamins and minerals. In the index, Greece and India top the ranks for the quality of their policy responses to dietary patterns.

Some have chosen the taxation route. For example, the UK and Mexico have imposed taxes on sugar in foods, while Norway, which has had a tax on added sugar since 1922, increased this tax by 83% in early 2018.¹¹ An evaluation published in the British Medical Journal of the sugar tax Mexico imposed in 2013 showed that, on average, the volume of taxed drinks bought in 2014 fell by 6% compared with pre-tax trends, a fall that increased to 12% by December 2014.¹²

The practice of taxing unhealthy food is not limited to countries with mature economies. Research conducted for the FSI shows that developing countries that have imposed taxes on processed food include Cameroon, Kenya, Nigeria, Senegal and Tanzania.

Tax solutions, which are often controversial and strongly opposed by industry, are not the only solution. Other approaches include education programmes at schools and colleges, public campaigns to encourage the consumption of healthy food, and policy measures to increase awareness among consumers.

“You want to create an opportunity for companies to change their portfolio because of consumer change—and governments can play a role in creating awareness or trying to price it into the product,” says Fokko Wientjes, vice-president of nutrition in emerging markets and food systems transformation at DSM, a Dutch nutrition and chemicals group.

In addition to public-health initiatives, the private sector also plays a role in tackling obesity, malnutrition and “hidden hunger” (a lack of sufficient vitamins and minerals). For example, often working with organisations such as the World Health Organisation (WHO) and the FAO, many global companies fortify popular, affordable foods with micronutrients in countries where malnutrition is a problem.¹³

LINKING NUTRITIONAL AND PLANETARY HEALTH

But while individual sectors can contribute to the creation of a sustainable food system, environmental sustainability, food waste, and health and nutrition are inextricably linked. For example, many argue that for the sake of the planet, food production should shift away from livestock and towards plants. This could also have a positive impact on global health. And research has found that the benefits of plant-based protein include the provision of protective effects against chronic degenerative conditions such as cardiovascular disease.¹⁴

To help introduce more plant-based proteins into the food system, Forum for the Future, an international sustainability non-profit, has launched the Protein

¹⁰ The Government of Spain, Spanish Strategy “More food, less waste”, https://www.oecd.org/site/agrfcn/Session%205_Alicia%20Crespo.pdf

¹¹ WEF, Will a sugar tax help reduce obesity?, <https://www.weforum.org/agenda/2018/03/will-a-sugar-tax-help-reduce-obesity/>

¹² World Cancer Research Fund International, Mexico’s sugar tax – did it make a difference?, <https://www.wcrf.org/int/blog/articles/2016/11/mexicos-sugar-tax-did-it-make-difference>

¹³ Unilever, Fortification to drive positive nutrition, <https://www.unilever.com/sustainable-living/improving-health-and-well-being/improving-nutrition/health-and-well-being-in-our-kitchen/fortification-to-drive-positive-nutrition/>

¹⁴ M Krajcovicova-Kudlackova et al, Health benefits and risks of plant proteins, *Bratislava Medical Journal*, 2005;106(6-7):231-4, <https://www.ncbi.nlm.nih.gov/pubmed/16201743>

Challenge 2040.¹⁵ Sally Uren, chief executive at Forum for the Future, points to the double win in this approach. “Not only do you reduce the carbon intensity of the food we’re eating,” she says. “But also plant-based protein is often better for you from a nutritional perspective.”

This means best practice must be based on an understanding that production, waste, nutrition and environmental sustainability are not separate issues: a healthy diet must also have a low environmental impact and conserve precious natural resources.

Leading US nutrition expert David Katz makes this link between a healthy human diet and the healthy planet needed to supply the natural resources for that diet. As he puts it, “there’s no such thing as a healthy diet that isn’t here for our kids to eat too”.

¹⁵ Protein Challenge 2040, <https://www.forumforthefuture.org/protein-challenge>



CHAPTER 1:

NUTRITIONAL CHALLENGES

Awareness is growing of the need to tackle obesity (causing severe medical conditions such as diabetes) as well as extreme hunger, undernutrition and “hidden hunger” (lack of vitamins and minerals). In addition, it is becoming clear that addressing nutrition (which is at the core of SDG 2 on zero hunger) is also closely linked to other SDGs such as clean water and sanitation (SDG 6), climate action (SDG 13), and sustainable consumption and production patterns, including waste reduction (SDG 12).

When it comes to a healthy diet, views differ widely. Many highlight the benefits of the Mediterranean diet, which is rich in olive oil, vegetables, fruits, legumes, cereals (mostly unrefined) and whole grains, with moderate amounts of dairy products, seafood and poultry, and red meat consumed in small quantities. Meanwhile, too much sugar intake has been associated with serious diseases, such as diabetes, heart disease and liver disease.¹⁶ Debates over what constitutes a healthy diet are likely to continue. However, what is clear is that the increasing amounts of processed and junk food consumed in recent years have contributed to a rising incidence of non-communicable diseases, such as diabetes and cardiovascular disease.

ADDRESSING HUNGER

A critical task for governments is to ensure that their citizens are not lacking sufficient nourishment. And while some progress has been made on reducing the number of hungry people globally, world hunger is on the rise again. Driven by factors such as conflict and climate change, the number of those facing chronic food deprivation rose to almost 821m in 2017, from about 804m in 2016, according to the FAO.¹⁷

As the FSI shows, sub-Saharan Africa is home to the world’s hungriest populations. With the exception of Saudi Arabia, Egypt, Indonesia and India, all the countries in the bottom 20 with respect to the prevalence of malnourishment are in sub-Saharan Africa (see table 1).

¹⁶ University of California San Francisco, Latest Sugar Science Research, <http://sugarscience.ucsf.edu/latest-sugarscience-research.html#W8x4LxNKh8c>

¹⁷ FAO, The state of food security and nutrition in the world, <http://www.fao.org/state-of-food-security-nutrition/en/>

TABLE 1
PREVALENCE OF
MALNOURISHMENT:
BOTTOM 20

RANK	COUNTRY	SCORE (OUT OF 100)
48	Saudi Arabia	77.4
49	Ghana	74.2
50	Egypt	71.5
51	Senegal	68.3
52	Cote d'Ivoire	65.1
53	Kenya	63.7
54	Cameroon	63.4
55	Burkina Faso	52.3
56	Uganda	51.3
57	Zimbabwe	50.6
58	Tanzania	48.7
59	Rwanda	48.6
60	Indonesia	47.3
61	Mozambique	44.1
62	Sierra Leone	38.6
63	Nigeria	37.8
64	Ethiopia	34.9
65	Zambia	34.5
66	India	22.2
67	Sudan	22

Notes: Scores are scaled from 0 to 100, where 100 = the highest sustainability and greatest progress towards meeting environmental, societal and economic Key Performance Indicators.

Source: Economist Intelligence Unit, Food Sustainability Index 2018

In finding solutions, some lessons can be learned from Brazil. Its National Policy for Food and Nutritional Security combined action by civil-society organisations with policies that tackled the root causes of hunger, such as going beyond increasing agricultural productivity to developing better distribution mechanisms. Initiatives included school meal and breastfeeding programmes,

community restaurants and nutritional surveillance systems. As a result, between 1990 and 2015 Brazil more than halved the proportion of citizens suffering from hunger.¹⁸

While tackling extreme hunger is one element of malnutrition, there is also a need for solutions to another serious nutritional challenge: lack of access to vitamins and minerals. Here, part of the problem is that the data are poor, and comprehensive and recent studies on micronutrient consumption are lacking globally. For example, research conducted for the FSI revealed that the most recent data on vitamin A deficiency is from 1995-2005.

This dual goal is expressed in SDG 2, the objectives of which include ending hunger and achieving food security, as well as improving nutrition. Shenggen Fan, director-general of the International Food Policy Research Institute (IFPRI), believes that the nutrition side of the goal is not receiving enough attention. “The suffering from micronutrient deficiency is an underestimated problem,” he says. “This is more serious than visible hunger.”

Partnerships have emerged to develop best practices in addressing micronutrient malnutrition. These include the Global Alliance for Improved Nutrition (GAIN), a non-profit that promotes public-private partnerships to fight malnutrition and increase access to nutritious, safe food, particularly for vulnerable communities.

GAIN has supported initiatives such as NutriRice, developed by DSM and Bühler Group, a Swiss food technology company. In its unmilled form, rice—the number one staple food in much of Asia—contains some macro and micronutrients. However, consumers want their rice to be white, requiring a process that removes up to 90% of its micronutrients.¹⁹ To create white rice that is also nutritious, the NutriRice process uses extrusion (combining high temperature with pressure), which turns broken rice kernels into

¹⁸ The Food Foundation and Institute of Development Studies, Brazil's food and nutritional governance plan, https://foodfoundation.org.uk/wp-content/uploads/2017/07/4-Briefing-Brazil_vF.pdf

¹⁹ New York Academy of Sciences, Technical Considerations for Rice Fortification in Public Health, https://www.dsm.com/content/dam/dsm/nip/en_US/documents/fortification_of_rice-technologies_and_nutrients.pdf

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rice-shaped grains that can be fortified with vitamins and minerals. Fortified rice kernels are added to natural rice in a ratio of 1:100 or 2:100, for example, thus guaranteeing a controlled intake of the right levels of vitamins and minerals.²⁰

DSM's Mr Wientjes argues that as policymakers, agri-businesses and others consider how to feed the world sustainably, the quality of nutrition is as important as the volumes of food produced. "You can't only focus on calories filling an empty stomach," he says. "You also need to look at the nutritional content."

Moreover, it is not sufficient to focus only on the food supply. Best practices in addressing malnutrition and undernutrition must be holistic. Since poor sanitation and a lack of clean water contribute to malnutrition resulting from diarrhoea, improved sanitation and better water services also help tackle world hunger. In Kenya, for example, Ikotoilets—public toilets designed for slum dwellers—not only improve sanitation for residents, but also reduce hunger.

NUTRITION FROM "WASTE"

However, in many places, healthy food can also be more expensive, raising affordability questions. One solution can be found in fixing another problem: addressing food waste turns out to be best practice when it comes to increasing the accessibility of food. France recognised this fact when in 2016 it introduced legislation requiring supermarkets to redistribute leftover food to charities serving poor communities.²¹

Some countries are making strides in lowering the risk for retailers that donate food. In the same year, Italy passed a law designed to reduce hurdles

to food donation. The bill removed health and safety regulations restricting the donation of food that is marginally past its sell-by date and complex requirements for maintaining sanitation and traceability standards for food donations.²²

In addition to France and Italy, research conducted for the FSI shows that other countries—Australia, Canada, the Czech Republic, Slovakia, Slovenia, Sweden and the US—have implemented similar legislation, either through laws reducing the liability of supermarkets when donating food or requiring them to donate rather than throw away food waste.

In the absence of legislation, social enterprises and charities are stepping in. In the UK, an enterprise called the Company Shop sells supply-chain surpluses from retailers through discount stores that are open to members, who are mainly food-industry workers. The stores, in economically disadvantaged areas, not only allow members to buy discount food, but members can also receive skills training, professional development and cooking classes.²³

Addressing post-harvest food waste can also help improve levels of nutrition. "In sub-Saharan Africa food waste is directly linked to nutrition because of how much is lost with post-harvest waste," explains Ms Cousin. "That limits the ability for economic generation for that family and affects that family's food security."

Meanwhile, insects—already part of the traditional diets of at least 2bn people, according to the FAO²⁴—could provide a new and rich source of nutrition, while increasing food security and contributing to stronger ecosystems and livelihoods. High in fat, protein, vitamins, fibre and minerals, insects can be reared with a low environmental impact since they consume human and animal waste, emit fewer greenhouse gases and require less water than livestock.²⁵

²⁰ DSM and Bühler Group, Nutrice Process: A breakthrough in rice fortification, https://www.buhlergroup.com/china/zh/downloads/NutriRice_Process_EN.pdf

²¹ *The Guardian*, French law forbids food waste by supermarkets, February 4th 2016, <https://www.theguardian.com/world/2016/feb/04/french-law-forbids-food-waste-by-supermarkets>

²² BBC, Italy adopts new law to slash food waste, August 3rd 2016, <https://www.bbc.co.uk/news/world-europe-36965671>

²³ Company Shop, Community Shop, www.companyshop.co.uk/community-shop/

²⁴ FAO, Edible insects: future prospects for food and feed security, <http://www.fao.org/docrep/018/i3253e/i3253e.pdf>

²⁵ Ibid

Recent EU legislation will support the development of this new source of food. Its 2018 regulation on novel foods makes it easier for companies to bring innovative foods to the EU market, while ensuring the safety of these foods.²⁶

TACKLING POOR DIETS AND OBESITY

Governments also need to respond to the rise of obesity—and there are compelling economic reasons for doing so. The WHO estimates that non-communicable diseases, such as diabetes and heart diseases, account for annual economic losses per person of US\$25 in low-income countries, US\$50 in lower-middle-income countries and US\$139 in

upper-middle-income countries.²⁷ In addition, the healthcare costs associated with these diseases put growing pressure on the public finances, with poor diets among the risk factors for these diseases.

The FSI captures the effects of diet on health, among other things, by measuring healthy life expectancy (HALE), based on data from the WHO's Global Health Observatory. For this indicator, Japan and Cyprus lead the way (see table 2). Sub-Saharan African countries such as Nigeria, Mozambique and Sierra Leone are among the worst performers in this category.

²⁶ European Commission, What is the current Novel Food legislation, https://ec.europa.eu/food/safety/novel_food/legislation_en

²⁷ WHO, From Burden to “Best Buys”: Reducing the Economic Impact of Non-Communicable Diseases in Low- and Middle-income Countries, <http://apps.who.int/medicinedocs/en/m/abstract/Js18804en/>



TABLE 2
HEALTHY LIFE EXPECTANCY:
TOP PERFORMERS

RANK	COUNTRY	SCORE (OUT OF 100)
1	Japan	100
2	Cyprus	97.2
=3	Australia	94.4
=3	Italy	94.4
=3	South Korea	94.4
=3	Spain	94.4
=7	Canada	91.7
=7	France	91.7
=7	Israel	91.7
=7	Luxembourg	91.7
=7	Sweden	91.7

Notes: Scores are scaled from 0 to 100, where 100 = the highest sustainability and greatest progress towards meeting environmental, societal and economic Key Performance Indicators.

Source: Economist Intelligence Unit, Food Sustainability Index 2018

Improving diets starts with improving agricultural practices. Part of the problem is that high-input farming, based on mono cropping—growing a single type of crop every year on the same land—not only threatens biodiversity, but also reduces the diversity of nutrients. Notwithstanding the existence of processes to make white rice as nutritious as possible (see the NutriRice example discussed earlier), some argue, for example, that industrial rice, which has a high glycaemic index that increases blood sugar levels, has contributed to diabetes in India.²⁸

²⁸ *The Guardian*, Seed freedom is the answer to hunger and malnutrition, August 28th 2013, <https://www.theguardian.com/sustainable-business/seed-freedom-hunger-malnutrition-biodiversity>

Meanwhile, an important best practice is informing consumers about the need for healthy choices and behaviour. All but eight countries in the index have government-led national policies and/or programmes to promote healthy eating patterns. And only 11 countries—Burkina Faso, Cameroon, Egypt, Ethiopia, Jordan, Mozambique, Nigeria, Senegal, Tanzania, Uganda and Zimbabwe—have not implemented healthy eating guidelines at the national level.

An example of best practice in this area includes updating guidelines, as our understanding of what constitutes a healthy diet evolves. For example, Denmark published its first set of dietary guidelines in the 1970s. These were revised in 1995, 2005, 2008 and 2013.²⁹

In developing guidelines, some policymakers have learned lessons along the way. Health Canada is among them. The agency's first food and nutrition guide was a single document that provided too much information for consumers and not enough for healthcare professionals or policymakers.

"We are now producing different guides for different audiences," says Hasan Hutchinson, director-general of the Office of Nutrition Policy and Programs at Health Canada. "So now our guide for policymakers is 70 pages, while for consumers it's much simpler."

Governments can support healthy diets in other ways, too. Education plays a critical role in the process of shifting consumers towards more sustainable diets. For the EU, the education system is a critical entry point. Its school fruit, vegetables and milk scheme supports the distribution of these foods to schools across the EU as part of a broader education programme on European agriculture and the benefits of healthy eating.³⁰ And, in Canada,

²⁹ FAO, Food-based dietary guidelines - Denmark, <http://www.fao.org/nutrition/education/food-dietary-guidelines/regions/countries/denmark/en/>

³⁰ European Commission, School fruit, vegetables and milk scheme, https://ec.europa.eu/agriculture/school-scheme_en

the government supports the Farm to School initiative,³¹ which includes learning opportunities that take place in school gardens, greenhouses, kitchens and classrooms, as well as on field trips to local farms, forests and lakes.³²

When it comes to pushing consumers in the right dietary direction, policymakers are trying to strike a balance between regulation (introduction of new food labels and requirements for companies to remove certain ingredients from foods, such as excessive amounts of salt and sugar, or to tax their use) and information (awareness-raising, labelling and public-health campaigns).

In the UK, for example, a sugar tax was recently imposed on soft drinks, requiring manufacturers to pay a levy on high-sugar drinks. The tax, expected to raise £240m (US\$311m) a year, will be used fund upgrades of sports facilities at schools and provide access to sports equipment for children.³³

Restrictions exist alongside incentives in many countries. In Canada, for example, some jurisdictions have placed limits on certain kinds of food outlets, such as fast-food outlets or convenience stores, while others have created incentives for food outlets offering nutritious foods, such as farmers' markets and grocery stores.³⁴

At Canada's federal level, Dr Hutchinson stresses that both regulation and guidelines—through measures such as labelling and food taxes and persuasion—and information campaigns—are important. "It's not one or the other—all our federal policy levers together reinforce each other," he explains. "It's a package of different interventions that will work in a

co-ordinated way to change the food environment and make the healthier choice the easier choice."

Cote d'Ivoire also uses a multi-pronged approach to shaping dietary patterns. As part of the government's National Nutrition Strategy, which has objectives such as creating healthy eating patterns, it promotes healthy eating guidelines, and nutrition education is compulsory within the national curriculum for primary schools. At the same time, it has imposed a tax on processed food and offers no subsidies on inputs for processed foods.³⁵

When it comes to nutrition, regulators play an important role in requiring food manufacturers to include healthy ingredients, such as vitamins, micronutrients and iodine, in their foods. In 2016, for example, the US Food and Drug Administration introduced a new nutrition facts label for packaged foods, reflecting new knowledge on the link between diet and chronic diseases, such as obesity and heart disease.³⁶

CHANGING CONSUMPTION PATTERNS

The good news is that in some places consumption patterns are changing, with a rise in demand for healthy, sustainable food. This could shift the market, encouraging the private sector to come up with new food products to meet this demand.

Large companies are responding, with some making acquisitions of smaller enterprises in the healthy food sector and others changing their offerings to include more healthy options.

³¹ Government of Canada press release, https://www.canada.ca/en/public-health/news/2017/10/government_of_canadasupportsnationalfarmtoschoolinitiative.html

³² Farm to School fact sheet, http://www.farmtocafeteriacanada.ca/wp-content/uploads/2015/11/f2s_aboutus_2015_en_online.pdf

³³ HM Treasury, Soft Drinks Industry Levy comes into effect, <https://www.gov.uk/government/news/soft-drinks-industry-levy-comes-into-effect>

³⁴ Government of Canada, Measuring the Food Environment in Canada, <https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/nutrition-policy-reports/measuring-food-environment-canada.html>

³⁵ National Nutrition Council, Plan national multisectoriel de nutrition 2016-2020, <http://www.nutrition.gouv.ci/actualite.php?lang=en>

³⁶ USFDA, Changes to the Nutrition Facts Label, <https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm>

NUTRITIONAL CHALLENGES

Examples include Danone's 2017 acquisition of WhiteWave, a company specialised in "better-for-you" food and drinks (including plant-based and organic products)³⁷ and Nestlé, which in the same year acquired Sweet Earth, a California-based manufacturer of high-quality plant-based protein foods such as burgers and burritos.³⁸ Meanwhile, McDonald's recently announced new nutrition standards and menu changes for its children's meals.³⁹ "The most important thing about the menu change is that it is bringing in an affordable version of healthier and more sustainably produced foods to their mass segments," says Eric Olson, senior vice-president at the US-based Business for Social Responsibility (BSR).

Meanwhile, a wave of start-ups is making the most

of the ability to sell their products online and finding success in offering new, healthy food products to consumers. A June 2018 analysis of venture funding in the food and beverage category by Crunchbase News found that start-ups in the sector had raised more than US\$3bn globally in the previous 12 months.⁴⁰ "There's a massive influx of small players, and most of them have broken into the food market with a health and sustainability proposition," says Solitaire Townsend, co-founder of Futerra, a UK-based sustainability consultancy.

This, she explains, is because the barriers to entry of getting into the food system have been lowered. "You used to have to be able to get on to the limited shelf space of a bricks-and-mortar retail environment. That's not the case anymore."

³⁷ Danone press release, <https://globenewswire.com/news-release/2017/04/12/959657/0/en/DANONE-Danone-Completes-Acquisition-of-WhiteWave.html>

³⁸ Nestlé press release, <https://www.nestleusa.com/media/pressreleases/nestle-sweet-earth-foods>

³⁹ *Washington Post*, "Can a Happy Meal ever really be 'healthy'? McDonald's is trying its best", February 15th 2018, https://www.washingtonpost.com/news/wonk/wp/2018/02/15/can-a-happy-meal-ever-really-be-healthy-mcdonalds-is-trying-its-best/?utm_term=.2777b70368a2

⁴⁰ TechCrunch, "VCs serve up a large helping of cash to startups disrupting food", June 16th 2018, <https://techcrunch.com/2018/06/16/vcs-serve-up-a-large-helping-of-cash-to-startups-disrupting-food/>



CASE STUDY

REVOLUTION FOODS

While research has found that the quality of school meals affects obesity levels, another compelling reason exists to improve the nutrition of schoolchildren—academic performance. “Undernourished kids just can’t concentrate as well in school and, therefore, are not able to perform academically and behaviourally,” says Kirsten Saenz Tobey, who, with her business partner Kristin Groos Richmond, founded Revolution Foods in 2006, an idea they developed while pursuing their MBA at the Haas School of Business at the University of California, Berkeley.

When assessing the quality of meals and snacks for schoolchildren in public schools across the US, they recognised that part of the problem was a lack of choice. “We were looking at schools that didn’t have cafeteria facilities and infrastructure and so they were beholden to whatever they could buy from a food distributor or local caterer,” says Ms Tobey. “It wasn’t that school leaders wanted to serve bad food—they just didn’t have options.” Often the only options were highly processed meals that arrived frozen, contained little nutritious value and were not appealing to students.

In founding Revolution Foods, therefore, the mission was not only to provide nutritious, healthy meals but also to ensure that those meals would be enjoyable. “We saw an opportunity for a meal programme that met federal guidelines in terms of being reimbursable by the federal government, but that was also delicious, well designed, one that served foods kids would be excited to eat and was nutritionally superior,” says Ms Tobey.

Twelve years on, the company is designing, producing and delivering 2m meals per week to 2,500 schools and community sites in 15 US states. In doing so, Revolution Foods has demonstrated that attracting investors and running a successful business are not incompatible with pursuing a social mission and that delivering healthy school meals that are affordable does not mean compromising on taste and nutrition.

This, plus the ability to scale up using investment capital, was the reason for creating Revolution Foods as a for-profit business rather than a charity. “Philosophically, we wanted to demonstrate that you can create a business as a force for social good,” says Ms Tobey.



CHAPTER 2:

SUSTAINABLE AGRICULTURE

To meet SDG 2 (zero hunger) and guarantee the nutritional needs of the more than 9bn people on the planet by 2050, the FAO has estimated that, under a business-as-usual scenario, food production will need to increase by 70%.⁴¹ However, there is growing consensus that rather than increasing production, expanding food availability while making farming less environmentally damaging should be a priority. Addressing food loss and waste is also part of this approach. Feeding the world sustainably means meeting rising demand without putting additional pressure on the planet's natural resources.

Food has a heavy ecological footprint—from carbon emissions to freshwater consumption—that needs to be addressed to achieve a sustainable global food system. For example, agriculture, including irrigation, watering and producing feeds for livestock, and aquaculture, is the world's largest water user. And the GHG emissions produced by livestock supply chains account for more than 14% of all human-caused emissions.⁴²

In terms of the environmental impact on water supply, the FSI shows that the top emerging economies of the BRIC countries—Brazil, Russia, India and China—and the US have the largest water footprint (data from the Water Footprint Network). The countries that do best in limiting their water footprint are Malta, Luxembourg, Cyprus, Jordan and Slovenia.

When it comes to sustainable water withdrawal, countries in the Middle East struggle in particular, with Jordan, Egypt, Saudi Arabia and the UAE in the bottom five (along with Sudan).

Best practice will require new approaches to sustainable farming that focus not only on increasing agricultural yields, but also on increasing access to food while conserving resources and reducing the environmental impact of farming, particularly the generation of GHGs.

This includes conserving groundwater. And a worst practice in agriculture is intensive use of groundwater in irrigation, which can deplete resources, reducing its availability for future use. In the FSI, sub-Saharan countries are best at limiting groundwater stress, with Ghana, Mozambique, Sierra Leone, Zambia and Zimbabwe the top performers, alongside Indonesia. Countries that face significant groundwater stress are particularly prevalent in the Middle East (see table 3).

⁴¹ FAO, How to Feed the World in 2050, http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf

⁴² FAO, Major cuts of greenhouse gas emissions from livestock within reach, <http://www.fao.org/news/story/en/item/197608/icode/>

TABLE 3
GROUNDWATER STRESS:
WORST PERFORMERS

RANK	COUNTRY	SCORE (OUT OF 100)
=52	Morocco	58.7
=52	US	58.7
54	China	54.3
=55	Austria	50
=55	Bulgaria	50
=55	Croatia	50
=55	Hungary	50
=55	Romania	50
=55	Slovakia	50
61	Mexico	28.3
62	India	26.1
63	UAE	17.4
64	Egypt	8.7
=65	Israel	4.3
=65	Jordan	4.3
67	Saudi Arabia	0

Notes: Scores are scaled from 0 to 100, where 100 = the highest sustainability and greatest progress towards meeting environmental, societal and economic Key Performance Indicators.

Source: Economist Intelligence Unit, Food Sustainability Index 2018

PRECISION FARMING

Precision farming and new digital tools can help, enhancing the efficiency and sustainability of farming, while improving yields. In the Netherlands, for example, Connecterra's dairy monitors track the behaviour and movement of cows, increasing grazing efficiency and predicting oestrous cycles, increasing the percentage of cows that become pregnant during a breeding season.

In the US, Indigo Agriculture is applying algorithms and machine learning to a database it has built of the microbes that live within plants to predict which of these are most beneficial to the plant's health. It applies these to crops in the form of a seed coating.⁴³

But while new technologies will play a role in securing a sustainable food supply chain, knowledge transfer is also critical, enabling countries to tap into existing technologies and practices. This helps reduce the levels of investment needed and enables developing countries to become less dependent on developed countries.

Moreover, best practices are not only to be found in developed economies or large agri-businesses. In moving to sustainable farming, lessons can be learned from developing countries. In Bangladesh, for example, the deep placement method used by millions of farmers reduces fertiliser use by about 30% and increases yields by 15% to 20%.⁴⁴

TRADITIONAL PRACTICES

Better use of traditional and existing practices can also contribute to a more sustainable food supply chain. For example, the FAO has found that greater use of existing best practices and technologies for feeding, health and husbandry could help the livestock sector cut GHG emissions by up to 30%. This would include better management of manure decomposition and the production, processing and transportation of animal feeds as well as increased use of energy efficiency and biogas generators.⁴⁵

When it comes to GHG emissions from agriculture, Cyprus, Malta, Lebanon, Luxembourg, Israel, Jordan and Slovenia have particularly low emission levels and lead the countries that rank highly in this indicator.

⁴³ Indigo Agriculture: <https://www.indigoag.com/>

⁴⁴ International Fertilizer Development Center, Rapid Introduction and Market Development for Urea Deep Placement Technology for Lowland Transplanted Rice, <http://www.mediatorre.org/docactu,cGV4aW5lZy9kb2NzL3VyZWVtZGVlcC1wbGFiZW1lbnQtdGVjaG5vbG9neQ==,11.pdf>

⁴⁵ FAO, Major cuts of greenhouse gas emissions from livestock within reach, <http://www.fao.org/news/story/en/item/197608/icode/>

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Traditional practices such as no-till or low-till farming, in which the soil is not disturbed—increasing retention of water, organic matter and nutrients—is also recognised as a sustainable method of farming. The adoption of no-tillage farming has been fastest in South America, where some countries are using the technique on about 70% of total cultivated land.⁴⁶

TechnoServe's Mr Belyi believes existing approaches can promote better yields for smallholders in the region while avoiding worst practices, such as exhausting the soil on existing farmland and clearing more forests to create additional farmland. "We want to help increase productivity on existing land with better agricultural practices and limited use of inputs and fertilisers," he says. "If farmers produce more volume for the same or very little incremental cost, that translates into additional income for their households. And that creates sustainability in terms of how much land is used for agriculture."

Tapping into local ecosystems, for example via using biomass and biodiversity, the traditional farming practices that make up agroecology can improve soil quality and achieve food yields that provide balanced nutrition and increase fair trade.⁴⁷

For example, in the Tanzanian village of Chololo, food, farming, forestry and resource management have been brought in line with the principles of agroecology. These include manure-based soil fertility improvements, water conservation techniques and optimal planting schedules. These practices have helped the village address challenges ranging from droughts and flooding

to human and livestock diseases, crop pests and diminishing groundwater supplies.⁴⁸

To promote such practices, the FAO recently decided to scale up agroecology to help meet the SDGs and the Paris Agreement.⁴⁹

In terms of the environmental impact of agriculture on land—an indicator that includes nitrogen use efficiency, soil quality for crop production and the average carbon content of soil as a percentage of weight—the FSI finds that Finland, Ireland and Canada are global leaders, while Sudan, Cyprus and the UAE struggle the most.

INNOVATION FUNDING

While venture capital and impact investments can support these kinds of start-ups in some parts of the world, particularly in the US and Europe, governments also need to play a role in fostering innovation in agriculture. In Europe, this has long been a focus of EU research funding. For example, the European Innovation Council's Horizon 2020 programme supports innovators and entrepreneurs, as do some of the funding instruments of the Common Agricultural Policy.⁵⁰

Other governments are also helping finance sustainable agriculture. In Burkina Faso, for example, a dedicated public institution has been set up to co-ordinate the parts of the national budget that are dedicated to agricultural innovation. Public funding supports, funds and co-ordinates R&D for agricultural innovation, and research institutes with an agricultural focus can receive funding from

⁴⁶ *International Journal of Agricultural and Biological Engineering*, Current Status of Adoption of No-Till Farming in the World and some of its Main Benefits, https://www.researchgate.net/publication/228692232_Current_Status_of_Adoption_of_No-Till_Farming_in_the_World_and_some_of_its_Main_Benefits

⁴⁷ FAO, Agroecology Knowledge Hub, <http://www.fao.org/agroecology/en/>; and AgroEcology Fund, What is Agroecology?, <https://www.agroecologyfund.org/what-is-agroecology/>

⁴⁸ IPES, Breaking away from industrial food and farming systems, http://www.ipes-food.org/_img/upload/files/CS2_web.pdf

⁴⁹ IISD, FAO Launches Initiative to Scale Up Agroecology in Support of the SDGs, <http://sdg.iisd.org/news/fao-launches-initiative-to-scale-up-agroecology-in-support-of-the-sdgs/>

⁵⁰ European Commission, Young farmers, https://ec.europa.eu/agriculture/cap-funding/young-farmers_en

the National Fund of Research and Innovation for Development (FONRID).⁵¹ In early 2018 the Appropriate Scale Mechanisation Innovation Hub-Burkina Faso received a nationally competitive grant to accelerate the process of scaling up a maize planter in response to FONRID's call for innovations in the area of "Sustainable Intensification of Agro-Forestry and Pastoral Production".⁵²

However, it can be hard to funnel money in from investors, particularly for developing countries. In the FSI, the top ten countries most likely to attract investment in sustainable agriculture are all European, with the exception of the US and Israel (see table 4). And while most countries in the index

offer some form of public financing for agricultural innovation, 12 countries—nine of which are in sub-Saharan Africa—do not.

⁵¹ FONRID, <http://www.fonrid.gov.bf/>

⁵² Kansas State University, Burkina Faso Innovation Hub Wins National Grant to Scale-Up Planter Technology, <https://blogs.k-state.edu/siil/2018/02/22/burkina-faso-innovation-hub-wins-national-grant-to-scale-up-planter-technology/>



SUSTAINABLE AGRICULTURE

TABLE 4
OPPORTUNITIES FOR
INVESTING IN SUSTAINABLE
AGRICULTURE: TOP TEN

RANK	COUNTRY	SCORE (OUT OF 100)
=1	Denmark	99.5
=1	Netherlands	99.5
=3	Germany	99.1
=3	US	99.1
5	Austria	98.1
6	France	95.8
7	Ireland	94.4
8	Belgium	93.1
9	Israel	92.6
10	Czech Republic	91.7

Notes: Scores are scaled from 0 to 100, where 100 = the highest sustainability and greatest progress towards meeting environmental, societal and economic Key Performance Indicators. The score for “opportunities for investing in sustainable agriculture” includes indicators for “sovereign debt risk” from The Economist Intelligence Unit’s Country Risk Model as well as for the existence of a strategy/policy on sustainable agriculture and inclusion of specific measures for promoting private sector investment in sustainable farming or availability of case studies around private sector investment in the mentioning specific investment targets.

Source: Economist Intelligence Unit, Food Sustainability Index 2018

FOOD AND CLIMATE ACTION

When it comes to the GHGs associated with agriculture, the Paris Agreement has given momentum to food-sector action. In the food and beverage industry, 86% of the 600 companies studied by Ceres, a US-based sustainability advocacy group,⁵³ have set specific timeframes to reduce

GHG emissions and many have set science-based targets⁵⁴—these are reduction targets that are in line with the global measures necessary to keep global warming within 2°C above pre-industrial levels, as set out in the Paris Agreement.

Last year Danone’s GHG reduction targets received official approval from the Science Based Targets initiative⁵⁵ as being in line with the global measures necessary to keep global warming below 2°C.⁵⁶

The French food and drinks company—which says that 60% of its carbon emissions are linked to agriculture⁵⁷—works with farmers to promote low-carbon practices such as increasing productivity and efficiency, reducing energy consumption and improving manure management. “In Europe, Danone has deep involvement in low-carbon farming,” says Eric Soubeiran, the company’s global nature, water cycles and human rights director.

The corporate sector plays a key role in reducing the GHG emissions associated with agriculture. And some see progress in this area. “An astonishing thing that’s happened around the climate side of this is that the food sector has been the most foot forward in setting extremely ambitious goals, including science-based targets,” says Mr Olson of the BSR, which, with the World Business Council for Sustainable Development (WBCSD), is developing a Climate Smart Agriculture initiative focused on farmer resilience, access to finance, supply-chain traceability and agriculture-related deforestation.⁵⁸

⁵³ Ceres press release, <https://www.ceres.org/news-center/press-releases/companies-show-signs-progress-new-ceres-analysis-calls-more-action>

⁵⁴ Climate Action News, Which U.S. Industries are Setting the Strongest Climate Goals, <https://insideclimatenews.org/news/24042018/american-companies-leaders-greenhouse-gas-targets-renewable-energy-ceres-study>

⁵⁵ Danone press release, http://danone-danonecom-prod.s3.amazonaws.com/COP_press_release_Final.pdf

⁵⁶ Science-Based Targets, What is a Science Based Target, <https://sciencebasedtargets.org/what-is-a-science-based-target/>

⁵⁷ Danone, Towards Carbon Neutrality, <https://www.danone.com/impact/planet/towards-carbon-neutrality.html>

⁵⁸ WBCSD, Climate Smart Agriculture, <https://www.wbcsd.org/Programs/Food-Land-Water/Food-Land-Use/Climate-Smart-Agriculture>

For Dr Fan of the IFPRI, these are the kinds of commitments he would like to see more of. “Without agriculture we will not be able to control the climate or temperature,” he says. “Agriculture and food systems play a huge role.”

The means of achieving these goals range from smart irrigation to animal feeds that minimise the methane emissions from livestock. And some best practices now emerging go back to ancient forms of farming, including cover cropping, different rotation patterns, and no-till farming, all of which build soil health. These enable the soil to retain water—making it more resistant to flood and drought—and build its carbon content.

THE NEED FOR COLLABORATION

Given the complexity of global food supply chains, collaboration is key, as highlighted by SDG 17, which seeks to strengthen global partnerships to meet the 2030 targets. And promoting best practices in sustainable farming often takes more than one sector. For example, through the Frameworks for Action, governments, industry and NGOs have come together to agree on concrete measures to eradicate deforestation resulting from cocoa production.⁵⁹

From adjusting the focus of subsidies to imposing carbon and storm water taxes, policymakers have an important role to play. The FAO is addressing this through the Economics and Policy Innovations for Climate-Smart Agriculture programme, which works with governments, research centres, universities and other institutional partners.

Meanwhile, as companies pursue sustainability strategies, they can bring together external partners to support their efforts. For example, French retailer Carrefour does this on an annual basis with

organisations such as the International Federation for Human Rights, which it has worked with since 2000, and WWF, which it has worked with since 1997.⁶⁰

Companies can also positively influence policymaking when it comes to the sustainability of the food supply chain. In 2018, for example, Whole Foods Market, a US retailer, ranked for the fifth time at the top of Greenpeace’s Supermarket Seafood Ranking, as well as at the top of the individual score for policy, for the sustainable tuna standards it launched in 2017 and for advocating for policy improvements in fisheries management.⁶¹

“As retailers, we have a huge opportunity to push for strong policy,” says Carrie Brownstein, global seafood quality standards co-ordinator at Whole Foods Market. “In seafood, that could be anything from pushing for strong fishery management to preventing illegal fishing, and we’ve written to federal agencies every year to address issues like these.”

IMPROVING AGRICULTURAL LIVELIHOODS AND SUSTAINABILITY

Although governments and large companies can make decisions that affect large volumes of food and agricultural commodities, it is smallholders who produce 70% of the world’s food.⁶² These farmers are generally poor and often need support in generating enough income to sustain their families before they can adopt agricultural practices that have a lower environmental impact. In fact, poverty is often a driver

⁵⁹ World Cocoa Foundation, Cocoa & Forests Initiative, <http://www.worldcocoafoundation.org/cocoa-forests-initiative/>

⁶⁰ Carrefour, An Ongoing Dialogue with Stakeholders, <http://www.carrefour.com/static/cdc/rapport-interactif-2011/en/consommation-1-commerce-responsable-dialogue.html>

⁶¹ Whole Foods Market press release, <https://media.wholefoodsmarket.com/news/greenpeace-ranked-whole-foods-market-no.-1-in-seafood-sustainability-for-fi>

⁶² FAO, “Coping with the food and agriculture challenge: smallholders’ agenda”, 2012: http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Coping_with_food_and_agriculture_challenge__Smallholder_s_agenda_Final.pdf

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of worst practices in farming. “It’s difficult to convince these farmers to think about sustainability—they think about survival,” says Mr Belyi. “And that forces them to stress the environment.”

This is the case in much of Latin America and the Caribbean, for example. Mr Belyi sets out some of the challenges farmers face. “These are people who, as a household, earn typically below minimum wage,” he says. “They own 1-3 hectares of land, and land title and ownership is still informal in many places, so as a result these farms don’t have access to capital.”

According to research done for the FSI, while most countries grant formal land rights to communities or individual smallholders, 16 countries do not, including the likes of Israel, Saudi Arabia and South Africa. When it comes to financial access and protection for land users, developed economies like Canada, Germany and Austria lead the way, while Sierra Leone, Egypt and Cameroon are the lowest-ranked countries.

The quality of agricultural subsidies also influences the lives of farmers. In the index, the top slots are taken by several sub-Saharan African countries (Mozambique, Nigeria, Sierra Leone, South Africa, Sudan, Tanzania, Uganda and Zimbabwe), alongside Argentina, Australia, Colombia, Israel, Morocco and the UAE. Meanwhile, lingering at the bottom of the ranking are a total of 36 countries, including Canada, China, Germany and the US.

In supporting smallholder farmers and helping them embrace sustainable agricultural practices, food and agribusiness companies can play an important role. For example, through its Livelihoods Fund for Family Farming, Danone invests in large-scale projects enabling farmers to produce greater yields and increased quality through sustainable agricultural practices.⁶³

Governments can also provide support for farmers through training programmes. Research for the index reveals that most countries have in place national or

semi-national training programmes for new farmers in sustainable agricultural practices. However, eight countries lack such plans, including Luxembourg, Malta, Russia, Turkey and several sub-Saharan African countries.

Technology is also enabling significant progress. In Kenya, Mozambique and Tanzania, for example, the Connected Farmer Alliance—a TechnoServe initiative with the US Agency for International Development and Vodafone, a UK telecoms company, as partners—is using mobile technology to connect farmers to multinational agribusinesses and facilitate payments, increasing the productivity, incomes and resilience of 500,000 smallholder farmers.⁶⁴

At the same time, enabling the transfer of knowledge and best practice between farmers is a powerful way of supporting smallholders. For example, about 1m African farmers are now asking each other questions and receiving crowd-sourced answers in minutes via text message via a service developed by UK-based Wefarm.⁶⁵ While the service is currently available in Kenya and Uganda, Wefarm plans to expand into other parts of eastern and sub-Saharan Africa.⁶⁶ And Rikolto, a Belgium-based NGO, helps small-scale farmers in Africa, Asia, Europe and Latin America to strengthen their businesses while embracing sustainable farming practices. It offers farmers assessment and business tools, customised training in finance, marketing and business model development, technical assistance and coaching advice.⁶⁷

Small-scale farmers also need protection against unpredictable events such as extreme weather. In West Africa, the Ghana Agricultural Insurance Programme (GAIP) brings together a pool of 19 Ghanaian insurance companies to provide drought

⁶³ Danone, Livelihoods Funds, L3F, <http://www.livelihoods.eu/l3f/>

⁶⁴ TechnoServe, Connected Farmer Alliance, <http://www.technoserve.org/our-work/projects/connected-farmer-alliance>

⁶⁵ Wefarm, <https://wefarm.org/>

⁶⁶ Wefarm, Wefarm Secures New Financing Round Led by True Ventures, <https://wefarm.org/wefarm-secures-new-financing-round-led-by-true-ventures/>

⁶⁷ Rikolto, <https://www.rikolto.org/en/about-us>

index insurance for maize, soy beans, sorghum, millet and groundnuts, as well as weather index insurance and poultry insurance.⁶⁸ In 2017 the GAIP introduced a pilot for livestock insurance.⁶⁹

Mr Olson says that efforts to improve agricultural livelihoods can create a double win. “What’s interesting about the interventions in agriculture is that there’s a near 100% overlap in the things you would do to build the resilience of farming communities and what you would do to mitigate for carbon.”

SUSTAINABLE DIETS FOR A SUSTAINABLE PLANET

What is good for human health is often also good for the planet. This means that the food choices of consumers can have an impact on the environmental sustainability of our food supply. The World Resources Institute (WRI) has identified several key areas where shifting diets could have a positive impact on human health while easing the need for agricultural land and cutting GHG emissions: reducing overconsumption of calories, reducing overconsumption of protein by reducing consumption of animal-based foods, and reducing consumption of beef.⁷⁰

In some places, this is going in the wrong direction. In countries such as China, Brazil and South Korea, rising incomes have led to increased consumption of meat,⁷¹ and its production takes a heavy toll on the environment through land use, the manufacture of fertilisers and animal feeds, and the methane emissions generated by livestock. Even in India, which has a strong culture of vegetarianism, consumption of meat is rising, with poultry production (eggs and broilers) rising at 8-10% a year, compared with 1.5-2% for crops.⁷²

In higher-income countries, people eat an average of 200-250g or more of meat per person per day.⁷³ This has a significant environmental impact. For example, in the US, beef consumption alone accounts for almost half the country’s diet-related agricultural land use and GHG emissions, according to the WRI.⁷⁴

However, in mature economies, appetite is growing for foods that are not only healthy but also environmentally sustainable, with consumers becoming more interested in the origins of their foods. “We’re living longer, people are taking better care of themselves, and the millennials are now parents and are raising children in ways of eating focused on health and sustainability,” says Futerra’s Ms Townsend.

Innovative companies are coming up with ways of shifting consumption to healthier and more sustainable patterns. For example, India-based start-up Good Dot is bringing affordable plant-based meats to Indian consumers.⁷⁵

Professor Katz hopes to strengthen the link between diet and environmental sustainability. He is working with a team of experts to measure and promote eating patterns that are good for both human health and the planet. “We will be working over the next year to develop the aggregated environmental footprint for the whole dietary pattern and using that to develop an app to coach people to reduce the environmental impact of their diet,” he explains. “There’s massive overlap in the shifts of diet we’d like to see for health and those we’d like to see for the sake of the planet.”

And WWF’s LiveWell project has been working to define sustainable, healthy diets—initially in the UK, Spain, France and Sweden—that are low in the generation of carbon emissions.⁷⁶

⁶⁸ GAIP, http://mofa.gov.gh/site/?page_id=12237

⁶⁹ GhanaWeb, GAIP to commence pilot of livestock insurance, February 3rd 2017, <https://www.ghanaweb.com/GhanaHomePage/business/GAIP-to-commence-pilot-of-livestock-insurance-506648>

⁷⁰ WRI, Shifting Diets for a Sustainable Food Future, https://wriorg.s3.amazonaws.com/s3fs-public/Shifting_Diets_for_a_Sustainable_Food_Future_1.pdf?_ga=2.218962139.397839254.1539774120-1181645573.1539774120

⁷¹ FAO, Livestock commodities, www.fao.org/docrep/005/y4252e/y4252e05b.htm

⁷² FAO, Growth and Concentration in India, <http://www.fao.org/wairdocs/LEAD/x6170e/x6170e09.htm>

⁷³ WEF, Meat: The Future, http://www3.weforum.org/docs/White_Paper_Meat_the_Future_Time_Protein_Portfolio_Meat_Tomorrow_Demand_report_2018.pdf

⁷⁴ WRI, Shifting Diets for a Sustainable Food Future, https://wriorg.s3.amazonaws.com/s3fs-public/Shifting_Diets_for_a_Sustainable_Food_Future_1.pdf?_ga=2.218962139.397839254.1539774120-1181645573.1539774120

⁷⁵ Good Dot, <https://gooddot.in/>

⁷⁶ WWF UK, Food patterns and dietary recommendations in Spain, France and Sweden, <http://www.livewellforlife.eu/wp-content/>

CASE STUDY

SUNCULTURE

When looking to sell solar-powered irrigation technology to smallholder farmers in Kenya, Samir Ibrahim and his co-founder Charles Nichols soon realised that their company, SunCulture, would have to go beyond simply selling equipment to providing financing and technical support.

The company's RainMaker uses a solar-powered electric pump to pull water from sources such as lakes, rivers, streams, wells and water harvesters and distributes the water via sprinklers or into raised tanks. Once the tank's valve is opened, gravity sends the water through irrigation pipes to the crops, with emitters regulating the flow to targeted areas.

However, for the Kenyan farmers that are SunCulture's customers, buying farming equipment is complicated. Farmers, explains Mr Ibrahim, need to know "where do I get it, how do I finance it, how do I use it and how do I fix it—everyone has that thought process, and we provide all that in one package".

He admits that developing this holistic, end-to-end solution has not been easy. "But even though it's difficult and there are faster short-term solutions, we are looking to be the most trusted technology partner for smallholder farmers around the world," he says. "And that means doing the hard stuff now."

In recent years, the company has been able to bring

down the price of its products and services from thousands to hundreds of dollars because of falls in everything from transport costs and the price of solar-energy equipment to its proprietary R&D. And the company says the equipment generates value (through a combination of savings and increased incomes) of more than US\$10,000 per year compared with using a petrol and furrow system. It also eliminates the more than 17 hours a week that farmers otherwise spend physically moving water.

However, Mr Ibrahim stresses that when developing technologies and services for poor communities, it is critical to remain customer-focused, to solicit user feedback and to ensure that quality is not sacrificed for affordability. "The single biggest driver for our successes so far has been putting the customer in the middle of everything that we do," he says. "These are some of the most underserved people in the world, but that doesn't mean they don't have high-quality standards."

While the company is currently only operating in Kenya, with distribution partners in Zambia and Uganda, Mr Ibrahim believes the SunCulture model can be applied in farming communities across the world. "We're focused on getting the Kenya model right before we take it anywhere else," he says. "But our ambition is to scale this operating model in as many countries as possible."



CHAPTER 3:

FOOD LOSS AND WASTE

Given the fact that about a third of the food the world produces is lost or thrown away,⁷⁷ sustainable agriculture can only go so far. Tackling consumer food waste and post-harvest waste (the loss of fresh produce and crops before they reach consumer markets) will involve everything from changing consumption patterns to investing in infrastructure and deploying new digital technologies. None of this is easy. But while enough food is already being produced to feed the world's population, ending hunger and meeting rising demand for food will not be possible without addressing this high level of food loss and waste.

WEF's Mr Cleene goes further. "You could sustainably intensify food production but if you haven't addressed food waste, sustainable intensification just increases the amount of food waste," he says. "What appears to be a good solution in one point in the value chain can exacerbate problems at another."

Post-harvest waste is a particular problem, and disproportionately affects smallholder farmers. Rockefeller Foundation research found that in sub-Saharan Africa some 40% of staple foods were failing to reach markets.⁷⁸ "The challenge with global food loss is inequity," says Matthew Reddy, director of Climate-Smart Agriculture at the World Business Council for Sustainable Development (WBCSD). "The people who are losing the most are the poorest people and the people that are dependent on getting their products to the marketplace."

The obstacles to greater efficiency are complex. In some cases, poor transport infrastructure and lack of storage facilities prevent food commodities from reaching markets, particularly in sub-Saharan Africa.⁷⁹ In the FSI, of the 21 countries that get the lowest or next-to-lowest scores in the quality of road infrastructure category, 14 are in sub-Saharan Africa (including the two lowest-ranked countries, Kenya and Sudan). Until recently, lack of measurement and tracking of supply-chain loss meant few focused on tackling the problem. Meanwhile, poor access to markets has meant that many farmers simply cannot get their produce to buyers before it deteriorates.

In Ghana, for example, an estimated 20-50% of the mango harvest is lost every year.⁸⁰ Causes range from the presence of fruit flies and disease but also a lack of cold chain facilities, long transit times, absence of on-farm energy sources and weak transport links. In addition, farmers lack knowledge of fruit-handling and post-harvest best practices, production potential and available varieties.⁸¹

ADDRESSING POST-HARVEST WASTE

To address these interlinked challenges, new post-harvest best practices are being developed. In one example, the Alliance for a Green Revolution in Africa is working with the Rockefeller Foundation.

⁷⁷ FAO, Food Losses and Food Waste, <http://www.fao.org/food-loss-and-food-waste/en/>

⁷⁸ Yieldwise: <https://www.rockefellerfoundation.org/our-work/initiatives/yieldwise/>

⁷⁹ Yieldwise case study, Shared Value Initiative, https://www.sharedvalue.org/sites/default/files/resource-files/YieldWise%20Case_Final.pdf

⁸⁰ IFPRI, Post-harvest losses: Global scale, solutions, and relevance to Ghana, <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/132322/filename/132532.pdf>

⁸¹ IFPRI, Post-harvest losses: Global scale, solutions, and relevance to Ghana, <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/132322/filename/132532.pdf>

FOOD LOSS AND WASTE

Starting with the Tanzanian maize value chain, the Yieldwise initiative emerging from this partnership tackles the problem at many levels. While it engages companies in providing storage technologies, it also helps to connect farmers to agricultural markets, increases access to finance and offers new tools for measuring and tracking post-harvest waste.⁸²

In Uganda, the US-based Louis Dreyfus Foundation is funding the creation of a “laboratory” for testing large-scale storage solutions that can minimise post-harvest loss in the region. The programme includes training workshops for farmers in best practices in harvesting, threshing, drying and storing their crops. The initiative also distributes tarpaulins, super grain bags and silos to farmers for storage purposes.⁸³

Governments are starting to fund initiatives that address post-harvest loss. For example, the Partnership for Growth, which is funded by the Danish government, recently made a grant to the US-based WRI and the WBCSD to run food loss and waste programmes in Indonesia, which, with a tropical climate and challenging logistics, is responsible for a large volume of food loss and waste. Indonesia is ranked 45th in the FSI when it comes to food loss as a percentage of total food production in the country (at 5.5%, according to FAO data for 2013).

As in other parts of the food system, digital technologies are playing an increasingly important role in reducing post-harvest waste. Digital marketplaces connect farmers with buyers for their fresh produce, enabling them to sell more and waste less.

For example, in April 2018, as part of the Digital India initiative, the Indian government launched three online portals to make it easier for farmers to export their products and cut transaction costs.⁸⁴

And, in Kenya, the M-Farm service allows farmers to access information on the retail price of their products and find buyers by texting the number 3555.⁸⁵

Some entrepreneurs are addressing the distribution and supply-chain challenges faced by small farmers. In India, for example, Crofarm buys fresh vegetables and fruits directly from farmers and delivers to online and offline retailers from distribution centres in the capital, New Delhi.⁸⁶

TACKLING CONSUMER FOOD WASTE

The second major food waste challenge is at the consumer end of the chain. While awareness is growing of the problem of consumer food waste, it remains a significant barrier to achieving a sustainable food system. According to the US Department of Agriculture, an estimated 30-40% of the food supply is wasted in the US, and in 2015 it introduced the country’s first food loss and waste goal of a 50% reduction by 2030.⁸⁷

Food waste has a negative effect on consumer incomes. In the UK, for example, food waste is worth an estimated £15bn (US\$19.7bn).⁸⁸ “It’s financial waste,” says Mr Reddy. “If people actually costed how much they’re wasting, it’s remarkable—and people aren’t aware of this.”

Policymakers in many parts of the world are taking steps to address the problem. The FSI includes an indicator that measures the quality of the policy response

⁸² AGRA, AGRA Yieldwise Maize Program in Tanzania, <https://agra.org/news/agra-yieldwise-maize-program-in-tanzania/>

⁸³ Louis Dreyfus Foundation, <http://louisdreyfusfoundation.org/our-work/micro-farming/projects/Post-harvest-loss-mitigation>

⁸⁴ *The Economic Times*, Government Launches Digital Platforms for Ease of Farm Export, April 3rd 2018, <https://economictimes.indiatimes.com/>

[news/economy/agriculture/government-launches-digital-platforms-for-ease-of-farm-export/articleshow/63599102.cms](https://www.techxlab.org/solutions/mfarm-m-farm; and M-Farm, http://www.mfarm.co.ke/posts)

⁸⁵ Technology Exchange Lab, <https://www.techxlab.org/solutions/mfarm-m-farm; and M-Farm, http://www.mfarm.co.ke/posts>

⁸⁶ YourStory, Agritech startup Crofarm helping farmers get the right price and cutting agri wastage, <https://yourstory.com/2017/09/crofarm-agri-supply-chain-startup/>

⁸⁷ USDA, <https://www.usda.gov/oce/foodwaste/faqs.htm>

⁸⁸ WRAP, WRAP restates UK food waste figures to support united global action”, <http://www.wrap.org.uk/content/wrap-restates-uk-food-waste-figures-support-united-global-action>

to food waste, based on sub-indicators such as food waste strategy, targets, legislation, regulatory agency, research, prioritisation framework, voluntary agreements, market-based instruments and private institutions. Countries with extremely low levels of food waste per head (all of which are developing countries) are assigned the highest score for this indicator. Otherwise, developed countries, led by the US, are the best performers (see table 5). However, while most countries have some form of high-level plan or strategy, concrete legislation is notably absent, with 45 countries lacking laws, regulations and regulatory instruments for end-user level food waste.

TABLE 5
POLICY RESPONSE TO FOOD WASTE: TOP PERFORMERS

RANK	COUNTRY	SCORE (OUT OF 100)
1	US	100
=2	Argentina	96.3
=2	Spain	96.3
4	South Korea	90.7
=5	France	88.9
=5	Italy	88.9
7	Netherlands	81.5
=8	Belgium	79.6
=8	Denmark	79.6
=10	Australia	77.8
=10	Canada	77.8
=10	Sweden	77.8

Notes: Scores are scaled from 0 to 100, where 100 = the highest sustainability and greatest progress towards meeting environmental, societal and economic Key Performance Indicators. Countries with extremely low levels of food waste per head (all of which are developing countries) are assigned the highest score for this indicator and excluded from this table.

Source: Economist Intelligence Unit, Food Sustainability Index 2018

As in other areas of food sustainability, collaboration is critical when it comes to addressing food waste—something the Australian government has recognised. In 2017 the then minister for the environment and energy convened the National Food Waste Summit, bringing together stakeholders from industry, business, academia, government and the not-profit sector to discuss ways of addressing the problem.⁸⁹

The EU recognised the need to bring different sectors together when it launched the EU Platform on Food Losses and Food Waste in 2016. The platform is intended to support a range of EU institutions, experts and other stakeholders in identifying measures that could prevent food waste, sharing best practice and evaluating progress.⁹⁰

Raising awareness among consumers is one approach. For example, a key element of Spain's More food, less waste strategy is the development of campaigns designed for consumers and the catering industry that both stress the importance of reducing food waste and suggest best practices for doing so. This includes promoting education programmes in schools, designing self-assessment tools for consumers and food industry companies, and preparing best practice guidelines on food management.⁹¹

Food labelling is another important tool helping consumers to make smarter purchasing decisions that lead to less food waste. When the European Commission looked into this, the results, published in February 2018, suggested that up to 10% of food waste in Europe is linked to date marking—such as “sell by”, “best by” and “use by” labels—on food products.⁹²

Meanwhile, the US passed a food date labelling

⁸⁹ Australian Government, Tackling Australia's food waste, <http://www.environment.gov.au/protection/waste-resource-recovery/food-waste>

⁹⁰ European Commission, EU Platform on Food Losses and Food Waste, https://ec.europa.eu/food/safety/food_waste/eu_actions/eu-platform_en

⁹¹ Spanish Ministry of Agriculture, Food and the Environment, Spanish Strategy “More food, less waste”, https://www.oecd.org/site/agrfcn/Session%205_Alicia%20Crespo.pdf

⁹² European Commission, Date marking and food waste, https://ec.europa.eu/food/safety/food_waste/eu_actions/date_marking_en

FOOD LOSS AND WASTE

act introducing standardised language for retail packaging in 2016. In research leading up to the passing of the act it had found that food date labelling practices create waste among consumers. This causes up to 90% of Americans to throw out fresh food occasionally and is thought to account for 20% of consumer waste of safe, edible food.⁹³

Even in the absence of policy leadership, companies can make a difference. In the US, for example, the Consumer Goods Forum, a network of 400 large global food and consumer-goods companies, is working with its members to simplify date labels on food products.⁹⁴

However, labelling remains a relatively blunt instrument. As science and technology advance, this could change. At the Massachusetts Institute of Technology, researchers have used nano materials to develop sensors that can detect the ethylene gas or biogenic amines that are emitted as food deteriorates. This could allow the development of “smart packaging” that would give retailers and consumers far more accurate information on the safety of food,⁹⁵ rather than leaving them to rely on imprecise and confusing “best before” labels, which are often interpreted as safety rather than quality labels. In one survey, for example, only 45% understood that “best before” dates were an indicator of food quality.⁹⁶

Successful business models are powerful drivers of change, and digital technology not only contributes to improvements in efficiency that cut waste but also result in higher profits for retailers. Among the most powerful tools is RFID technology. RFID tags equipped with sensors that are installed in fresh produce pallets can tell retailers whether or not the correct temperature has been maintained throughout

the journey.⁹⁷ If temperature changes have reduced the food’s shelf life, supermarkets can discount it in order to sell it more quickly.

Seeing the opportunities, start-ups with smart ideas are addressing the problem. In Japan, for example, tech entrepreneurs are making it easier for people to make use of food that would otherwise be wasted. For example, the Reduce Go app allows registered users to collect unused food from restaurants and food outlets for a monthly fee of ¥1,980 (US\$17.50). And CoCooking, a Tokyo-based food service company, has launched the Tabete website, which allows consumers to buy meals and food products that would otherwise be thrown away.⁹⁸

In the UK, Rubies in the Rubble is tackling food waste by making condiments sustainably from ingredients that would otherwise go to waste, often for simply being the wrong shape, size or colour. The company says that by September 2018 it had saved more than 4.3m fruits and vegetables from going to waste.⁹⁹

MARRYING FOOD SUSTAINABILITY AND PROFITABILITY

As solutions such as the Rubies in the Rubble condiments and use of RFID tags on fresh produce demonstrate, best practices in tackling food waste do more than address an environmental problem. They also provide new business models and help companies increase their profitability.

To do so, however, they need to take action. A recent Boston Consulting Group (BCG) study identified

⁹³ US Congress, Food Date Labeling Act of 2016, <https://www.gpo.gov/fdsys/pkg/BILLS-114hr5298ih/pdf/BILLS-114hr5298ih.pdf>

⁹⁴ The Consumer Goods Forum, Reducing Food Loss & Waste, <https://www.theconsumergoodsforum.com/initiatives/environmental-sustainability/key-projects/food-solid-waste/>

⁹⁵ MIT News, MIT sensor detects spoiled meat, April 14th 2015, <http://news.mit.edu/2015/sensor-detects-spoiled-meat-0415>

⁹⁶ NFWI, Wasted opportunities: How supermarkets can help tackle food waste, www.thewi.org.uk/_data/assets/pdf_file/0009/193761/Food-Matters-FINAL-indiv-web-low.pdf

⁹⁷ The Royal Society Publishing, Reducing food losses by intelligent food logistics, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4006167/>

⁹⁸ Japan Times, Tokyo-based startups look to link consumers with restaurants to curb food waste, May 4th 2018, <https://www.japantimes.co.jp/news/2018/05/04/national/tokyo-based-startups-look-link-consumers-restaurants-curb-food-waste/#.W7ZCb5NKh8d>

⁹⁹ Rubies in the Rubble, <https://rubiesintherubble.com/>

13 best practices that companies can take to address food loss and waste—from training farmers and farmworkers and designing new forms of food packaging to improving cold chain infrastructure, using key performance indicators to improve their processes. BCG found that the benefits ranged from making cost savings and discovering new revenue streams to improving relationships with farm suppliers and attracting new socially conscious customers.¹⁰⁰

“This is one of those no-regrets, no-brainer options that we should be investing in right now,” says WBCSD’s Mr Reddy. “Commercially it makes sense, from an environmental perspective of view it makes sense, and all the case studies show positive financial returns for companies that invest in food loss and waste measures—sometimes in the region of ten to one.”

A CIRCULAR APPROACH

Bringing together many of these approaches, the circular economy—in which waste, energy and other materials are fed back into the production chain—holds great potential to address food loss and waste.

Through anaerobic digestion, food waste can be turned into energy. In Europe, adoption of biogas digesters has been widespread. By 2014 about 14,000 municipally run biogas digesters were operating across the continent, with nearly 9,000 in Germany alone.¹⁰¹

Meanwhile, innovative entrepreneurs have been tapping into circular-economy principles to develop products made from food waste. In Italy, for example,

start-up Orange Fiber is producing sustainable fabrics made from the by-products of citrus juice.¹⁰²

And food itself is not the only waste material to which the circular economy could provide solutions. Attention has recently intensified on reducing the plastic packaging used to preserve and transport food, particularly because of its contribution to the pollution of rivers, lakes and oceans. Yet cutting back on the amount of packaging used for food is only a partial solution, since lack of packaging results in more food spoilage. This makes it important to develop biodegradable alternatives to plastic that could be returned to the supply chain via the circular economy.

Food producers and retailers will play an important role in setting goals that will drive innovation in this area. Unilever is among them. In 2017 the Anglo-Dutch consumer products group committed to ensuring that 100% of its plastic packaging would be fully reusable, recyclable or compostable by 2025.¹⁰³ And in Bali, Indonesia, in 2018 Nestlé was among the companies and governments that signed The New Plastics Economy Global Commitment at Our Ocean Conference, an initiative of The Ellen MacArthur Foundation and UN Environment.¹⁰⁴

Policymakers can also promote the circular economy. In 2015, for example, the EU launched an action plan for the circular economy. It argues that its principles and practices are not only a means of conserving valuable natural resources and cutting GHG emissions but can also “boost the EU’s competitiveness by protecting businesses against scarcity of resources and volatile prices, helping to create new business opportunities and innovative, more efficient ways of producing and consuming”.¹⁰⁵

¹⁰⁰ BCG, Tackling the 1.6-Billion-Ton Food Loss and Waste Crisis, <https://www.bcg.com/en-us/publications/2018/tackling-1.6-billion-ton-food-loss-and-waste-crisis.aspx>

¹⁰¹ YaleEnvironment360, On Front Lines of Recycling, Turning Food Waste into Biogas, https://e360.yale.edu/features/on_front_lines_of_recycling_turning_food_waste_into_biogas

¹⁰² Orange Fiber, <http://orangefiber.it/en/about/>

¹⁰³ Unilever, Rethinking plastic packaging – towards a more circular economy, <https://www.unilever.com/sustainable-living/reducing-environmental-impact/waste-and-packaging/rethinking-plastic-packaging/>

¹⁰⁴ Nestlé press release, <https://www.nestle.com/media/pressreleases/allpressreleases/addressing-plastics-waste-pollution>

¹⁰⁵ European Commission, Closing the loop - An EU action plan for the Circular Economy, https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1&format=PDF

CASE STUDY

WINNOW

Behind the scenes, in the frantic world of a restaurant kitchen, getting food through the door and on to the dining room table can be an all-consuming exercise. Thinking about how much food is being wasted in the process often falls lower on the agenda. This is bad for both the environment and the bottom line—and it is something Kevin Duffy and Marc Zornes, founders of London-based Winnow, want to change.

About 20% of what is being purchased by the industry is never consumed by a human, explains Kevin Duffy, co-founder of Winnow, with about 70% of that not “plate waste” (food left by diners) but “pre-consumer waste” (pre-cooked batches of food, trimmings and spoilage). Since in landfill sites, food produces methane, a powerful greenhouse gas, cutting this waste is a critical tool in moving to more sustainable food systems.

To address the challenge, Winnow has developed smart meter technology that, when attached to waste bins, helps chefs to measure, monitor and reduce food waste using just a few clicks. Kitchen staff dispose of food as normal, but when they do, they choose the source of waste and the food menu item and, in a few seconds, the technology provides feedback on the food cost.

The result is a real-time picture of how much and what types of food are being wasted.

The data make it easy to identify the biggest sources, whether because certain ingredients are unpopular with customers, storage facilities are inadequate or preparation techniques are inefficient. “We have to make it really simple to collect the data and feed it back in a way that makes it easy for the chef to make changes,” says Mr Duffy.

Those changes may be modest—from improving storage facilities and adapting kitchen layouts to making more accurate decisions on how much food to prepare in advance. “None are rocket science, but they become obvious once people have the data at their fingertips,” explains Mr Duffy.

And the return on investment can be swift and attractive, with 95% of the company’s clients seeing a return in less than a year, and many getting back more than three times the money they have invested in the technology.

And while individual restaurants can use Winnow’s system, the company targets large foodservice and hospitality enterprises. “Our objective is to have a really meaningful impact on a global scale,” says Mr Duffy. “So we’ve focused on big enterprise clients and grown with them into the other countries where they operate. So even though we’re still a relatively small company, we’re in about 40 countries today.”





CASE STUDY

#SINDESPERDICIO (#NOFOODWASTE)

Like much of the rest of the world, Latin America generates large amounts of food loss and waste. This occurs at every stage of the food chain, from the production process, where 28% is wasted, to handling and storage (21%), processing (6%), distribution and marketing (17%), and when in the hands of consumers (about 28%).¹⁰⁶ To make a dent in these losses, the Inter-American Development Bank (IDB) is working with companies such as IBM, Nestlé, Coca-Cola, Dow Chemical, Bimbo, FEMSA and Oxxo, as well as organisations such as the Global Foodbanking Network, the FAO, the WRI and the Consumer Goods Forum, through #SinDesperdicio (#NoFoodWaste), a three-year initiative that launched on World Food Day on October 16th.

For the IDB, the #SinDesperdicio initiative is part of the bank's support for SDG 12.3, which seeks to cut the per-head food waste and reduce production and supply-chain losses by half by 2030. Discussions about sustainable agriculture and the food-water-energy nexus in Latin America have so far been largely limited to how to increase productivity, says German Sturzenegger, water, sanitation and solid waste senior specialist at the IDB. "But the food-waste issue is not being discussed. We're trying to change that."

The initiative will provide seed funding of US\$1.4m (US\$1m from the IDB and US\$400,000 from its partners) to commission studies, identify innovative projects and develop policy proposals for solutions that can quantify food waste and start to change behaviour among producers, suppliers, retailers and consumers. Further funds will be raised from all partners for the implementation of these projects.

Mr Sturzenegger stresses the importance of having a wide variety of partners in the #SinDesperdicio platform. "It's super important not to work in silos," he says, adding that while this is not the bank's first food-waste project, the scale of collaboration is new. "You need integration and synergies," he points out. "Working in partnership will accomplish a network effect and multiply the impact that we can have."

¹⁰⁶ IDB press release, <https://www.iadb.org/en/news/business-leaders-and-idb-issue-call-reduce-food-waste-latin-america-and-caribbean>



CONCLUSION

It is hard to overestimate the challenges facing the global food system. Ensuring all people on the planet are able to feed themselves with dignity while preventing the depletion of precious water conservation and reducing the GHG emissions that cause global warming will be far from easy.

Recognition of the need to address the sustainability of food has been a long time coming. However, the increasingly frequent and damaging weather events such as floods and droughts have focused minds on the need for action. And it is becoming clear that a more holistic approach to sustainability in the global food system must be adopted.

This is underlined by the SDGs, where many of the 2030 objectives—from zero hunger and health and wellbeing to climate action—are closely interlinked.

In the world of food, best practice covers a wide range of activities, from sustainable agricultural techniques and measures to prevent food waste to efforts to improve the health and nutritional value of food. As this report demonstrates, through all these activities, best practice needs to harness ideas that are innovative, replicable, scalable, financially feasible and that make a meaningful impact on the sustainability of the global food system.

The challenge for policymakers, companies and others is bridging the gap between different elements of the food system such as production and nutrition or nutrition and sustainable farming.

And while the different segments of the global food supply chain have often worked in isolation, there is a growing realisation that a more integrated approach to the food chain is needed.

Best practices should include all players in the supply chain, from governments to the private sector, smallholder farmers, academia, international organisations and consumers.

For example, with their global reach and access to finance and technology, companies can do much to advance the sustainability of food. However, to do so they need governments to create the regulatory frameworks and incentives that support good farming practices.

And consumers can become engaged in reducing food waste. But their contribution will ultimately be limited unless, for example, companies produce food packaging that is biodegradable or recyclable or unless local municipalities offer recycling facilities.

Governments also need to do more collaborating among themselves. Failure to do so can have dire consequences. For example, during the 2007 and 2008 food crisis, some countries acted to protect their domestic food supplies by introducing export bans, something many argue is a worst practice that undermines food security and exacerbated rising prices.

Meanwhile, the different challenges of delivering food sustainably need to be treated together. For example, countries are seeing the double win in addressing

food loss and waste since this both reduces the environmental impact of food—which releases an annual 3.3bn tonnes of GHGs into the atmosphere¹⁰⁷—and makes more food available, whether on the farm in developing countries or through the food redistribution practices of supermarkets.

As this example demonstrates, there are huge gains to be made from this approach. More work needs to be

done to develop best practices that link sustainable agriculture, food loss and waste, and nutrition.

It is increasingly clear that tackling each of the pillars of the food system alone will not be enough to achieve food security sustainably and meet the SDGs. Given the complexity of the food system and its relationship to human, planetary and economic health, all players need to be engaged. In delivering a global food system that is also sustainable, solutions must be holistic and all sectors need to play their part.

¹⁰⁷ FAO, Food waste harms climate, water, land and biodiversity, <http://www.fao.org/news/story/en/item/196220/icode/>



APPENDIX

The Food Sustainability Index (FSI), which ranks 67 countries on food system sustainability, is a quantitative and qualitative benchmarking model. It is constructed from 37 indicators and 89 individual metrics that measure the sustainability of food systems across three categories: food loss and waste, sustainable agriculture, and nutritional challenges. The index has three key performance indicators—environmental, societal and economic—which are in turn based on eight themes selected on the basis of expert analysis by The Economist Intelligence Unit in consultation with an advisory board.

The three category scores are calculated from the weighted mean of underlying indicators and scaled from 0 to 100, where 100 equals the most sustainable. The overall score for the FSI is calculated from a weighted average of the category scores on a 0-100 scale. A full list of indicators and metrics as well as indicator definitions, scoring criteria and sources are available on the FSI hub online and in the downloadable Excel workbook.¹⁰⁸

¹⁰⁸ The full methodology and index results can be downloaded here: <http://foodsustainability.eiu.com/resources/>.



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