The Economist INTELLIGENCE UNIT

Global Food Security Index 2020

Addressing structural inequalities to build strong and sustainable food systems

SUPPORTED BY CORTEVA™ agriscience

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Preface

The Global Food Security Index (GFSI), developed by The Economist Intelligence Unit (EIU) and supported by Corteva Agriscience, considers food affordability, availability, quality and safety, alongside natural resources and resilience, across 113 countries. The index is based on a dynamic benchmarking model constructed from 59 qualitative and quantitative indicators that measure the drivers of food security in developing and developed countries.

This edition of the GFSI incorporates the "Natural Resources and Resilience" category into the main index. This category assesses a country's exposure to the impacts of a changing climate; its susceptibility to natural resource risks; and how the country is adapting to these risks, all of which impact food security. The category was first introduced into the GFSI in 2017 as an adjustment factor and, given its increasing importance, has been included as a main category for the first time this year.

This report is based on research conducted by the EIU between April and September 2020. The EIU bears sole responsibility for the content of this report. The findings and views expressed do not necessarily reflect the views of the partners, experts or sponsors.

The 113 countries included in the GFSI cover five regions—Asia Pacific, Europe, Latin America, the Middle East and Africa, and North America. In addition to the global report, reports for each region are also available, providing deeper analysis of region-specific performance in the 2020 index.

The GFSI 2020 model, the global research report and all five regional reports are available online at https://foodsecurityindex.eiu.com/. Please visit the website for more information on the global rankings, key findings and 2020 methodology.

We would like to extend our thanks to the researchers, writers, editors and graphic designers who lent their expertise to this project. The following economists, researchers, country analysts, and food, climate and natural resource specialists contributed to this research programme.

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The project team is also grateful for the contribution of the experts who volunteered their time and expertise to inform the index methodology and research.

Our expert panel

The methodology for the GFSI was developed by the EIU in consultation with a peer panel of experts. Each year, the methodology is reviewed to ensure that the index remains a credible, frequently referenced and trusted source of information for stakeholders looking to better understand the global environment for food security.

The first peer panel meeting was designed to engage a panel of experts from the academic, non-profit, and government sectors to help select and prioritise food security indicators through a transparent and robust methodology. Their diverse backgrounds and extensive experience ensured that a wide variety of views were considered. The panel met as a group in February 2012 in Washington, DC to review the framework, selection of indicators, weighting and overall construction of the index. The panel has also provided ongoing support, as needed, throughout all editions of the index, as well as advising on the selection of weightings.

Expert panel participants

Ademola Braimoh
Senior Natural Resources Management Specialist, World Bank

Margaret Enis
Director of the Office of Markets, Partnerships and Innovation, US Agency for International Development (USAID) Bureau for Food Security

Craig Gundersen
ACES Distinguished Professor, Agricultural Strategy, Department of Agricultural and Consumer Economics, University of Illinois at Urbana Champaign

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Research Professor, Tropical Soils, University of Florida.

David Spielman
Senior Research Fellow, International Food Policy Research Institute

Robert Thompson
Senior Fellow, Chicago Council on Global Affairs

Patrick Westhoff
Director, Food and Agricultural Policy Research Institute; Howard Cowden Professor of Agricultural and Applied Economics, University of Missouri.

For the sixth iteration of the GFSI, the EIU convened an additional expert panel in March 2017 to assist in the development of a fourth index category, "Natural Resources and Resilience", which captures climate-related and natural resource risks to global food security. The following experts on climate change and natural resources participated in the meeting:

Joe Glauber
Senior Research Fellow, International Food Policy Research Institute

Elise Golan
Director, Sustainable Development, US Department of Agriculture

Susanna Hecht
Professor of Urban Planning, University of California, Los Angeles

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Dawn Rittenhouse
Director, Sustainable Development, DuPont

Allison Thomson
Vice-President, Science and Research, Field to Market: The Alliance for Sustainable Agriculture

Sonja Vermeulen
Director of Programmes, CGIAR System Management Organisation

Sara Walker
Senior Manager, Water Quality and Agriculture, World Resources Institute

The EIU continues to review the framework and methodology annually to strengthen each iteration. As part of the review process in 2020, The EIU consulted several new experts, along with a few from past panels, to ensure the index remains a powerful tool in highlighting the major challenges for food security worldwide. The following additional experts were consulted during this review:

Boaz Keizire
Head of Policy and Advocacy, Alliance for a Green Revolution in Africa

Paul Winters
Associate Vice-President, Strategy and Knowledge Department, International Fund for Agricultural Development

Lauren Phillips
Lead Advisor, Policy and Results, International Fund for Agricultural Development

Abdul Sattar
Statistician, Statistics & Food Security and Nutrition team, Statistics Division, Food and Agriculture Organisation

Akmal Siddiq
Chief, Rural Development and Food Security Thematic Group, Asian Development Bank

Executive summary

Even before the covid-19 pandemic, food insecurity worldwide was on the rise. The current crisis threatens to deepen this reversal, erasing progress made in the fight to eliminate global hunger and malnutrition. As incomes fall and supply chains are upended by restrictions of movement and logistics due to the pandemic, the world continues to struggle to address pre-existing threats to food security, most particularly worsening climate and environmental dynamics, including inadequate rainfall, rising temperatures, floods and extreme weather.

In times of crisis, the effects of systemic gaps are felt more deeply. Amid the spread of covid-19, economic, social and environmental inequalities have had a major impact on how countries have been able to meet the food, health and economic needs of their populations. The pandemic has exposed the risk that these factors pose to food systems and highlighted the importance of examining not just the current levels of food insecurity, but also the underlying drivers and causes.

The Global Food Security Index (GFSI), a holistic measure of national food systems, focuses on examining and analysing the drivers behind food security in countries worldwide. The index takes into account how effectively a country is able to meet its population's caloric and nutritional needs while also examining the impact of external factors such as agricultural infrastructure, political stability and climate risks, among others.

The 2020 GFSI, the ninth edition of the index, tracks the performance of 113 countries in providing for the dietary needs of their populations. The report evaluates the implications of technological developments, such as agricultural innovation and mobile-phone penetration, on food systems, and continues to track long-term food security trends such as policy progress in areas such as nutritional surveillance and national strategy formation. This year, the report includes a special focus on how inequalities—economic, gender and environmental—can magnify the impact of a food security crisis across and within countries.

For the first time this year, the index incorporates "Natural Resources and Resilience" as part of the core index. This category, first introduced in 2017, measures exposure to climate shocks, water and land-quality issues, population pressures, and government commitments to addressing the impacts of climate change on agriculture. Originally, this category was included as an adjustment factor to countries' baseline food security scores. By making natural resources and resilience a core pillar of the index, the importance of these factors in shaping overall national food security is more fully reflected, helping to address a common tendency to separate two issues that are, in fact, inextricably linked.

As a result of this methodological change, the scores and rankings in the 2020 model are not directly comparable with those in the previous editions of the index. We have, however, included updated data and scores (using the new methodology) for the 113 countries included in the GFSI for 2012-20 in this edition of the index. The inclusion of this new category in the overall food security environment has affected

individual country performances considerably. However, it has also provided an opportunity for policymakers to incorporate the impact of climate-related factors into the dialogue on food security in their countries.

This report combines the index trends and results with an examination of how an unexpected crisis (the covid-19 pandemic) and long-term structural factors, such as climate risk, are exacerbating existing vulnerabilities in the global food system; conversely, however, both these immediate and longer-term factors are also creating opportunities and space for creative solutions and innovation.

Key findings

The GFSI highlights the importance of addressing the root causes of food insecurity through effective policies, and creating a stronger, more resilient and sustainable global food system. Whereas the GFSI recorded continuous improvements in the overall food security environment in 2012-18, there was a deterioration in the global food environment in 2019; this is followed by a second, marginal, decline in 2020.[1] Moreover, the covid-19 pandemic has underscored why it is critically important to examine the underlying drivers of food security. In times of economic prosperity and peace, the impact of vulnerabilities in food systems may not be as acutely felt. However, during times of political or socio-economic turmoil, national, regional and global efforts to strengthen food systems determine the impact on overall levels of food security. The GFSI highlights these vulnerabilities and identifies where change is needed to reduce both baseline food insecurity and the risk of acute food insecurity during times of crisis.

This year's index includes "Natural Resources and Resilience" as a fourth main category for the first time, reflecting the impact of climate change on the overall food security of countries included in the index. This change in methodology reveals the true threat of climate change to food security and the need to incorporate it as an integral part of building resilience in the global food system. In addition, this year's index provides new data and insights for critical metrics, including inequality-adjusted income, gender inequality and armed conflict.

This report presents 12 key findings from the GFSI 2020:

- **While more than half of the countries have reduced poverty since the first edition of the index, some countries, particularly in Asia, have made remarkable progress**. China, Myanmar and Indonesia, along with Ghana, have made the most significant improvements since 2012. On the other hand, the index also highlights 20 countries that have experienced a gradual increase in poverty levels since the 2012 edition of the index. While the rate of decline in poverty rates was already slowing prior to the pandemic, the covid-19 outbreak could further exacerbate this and is likely to reverse gains made in reducing poverty over the past two decades. Early evidence shows that the pandemic and the resulting lockdowns have had a disproportionate impact on the economically vulnerable and those living below the poverty line. In urban areas, informal workers and migrants have been affected by rising food prices, while smallholder farmers have faced income and food uncertainties.

- **The 2020 index measures income and standard of living through the lens of inequality-adjusted income levels for the first time**. Unsurprisingly, Europe performs well on this indicator—13 of the top 15 countries are European. High income levels, coupled with relatively low rates of inequality, indicate more equitable access to resources and a better ability to cope with the types of unexpected economic shocks that can drive food insecurity, particularly for the most

1 This is according to data in the 2020 edition of the index. The overall food security score (average of the 113 countries included in the index) increased consistently from 57.75 in GFSI 2012 to 61.10 in GFSI 2018. It declined in the 2019 and 2020 indices (to 60.72 and 60.44 respectively). These averages are out of a total score of 100.

vulnerable. Notably, some Latin American countries, including Bolivia, Panama and Peru, have also made significant improvements on this indicator since 2012.

- **Adequate resourcing and effective implementation of food safety nets can protect vulnerable groups**. **Positively, the latest index finds that 110 out of the 113 countries have a food safety net in place**. While the type of food safety net can vary across countries (varying from food vouchers to direct cash transfers or school meal programmes), the Democratic Republic of Congo, Syria and Yemen are the only countries that do not have a food safety net in place. Most recently, however, the pandemic has highlighted gaps in the functioning of these safety nets. As highlighted by the GFSI, food safety nets in 47 countries lack adequate funding to cope with a crisis, and 36 countries lack national coverage. However, it is worth noting that in the past months, many governments have released substantial cash transfers and financial aid programmes to safeguard the unprotected from income shocks. While much of this recent assistance is temporary, countries can benefit in the long term by providing stable, transparent and well-targeted support programmes that can withstand the test of unexpected economic crises.

- **The 2020 index shows improved access to food market data and mobile banking in 63 out of 113 countries**. Asia and Sub-Saharan Africa have seen the highest improvements on this indicator. Governments in these regions can further deploy mobile technology to provide targeted support such as timely information, targeted agriculture advice and financial services to smallholder farmers. The current pandemic has seen China, Malaysia and Ghana successfully using e-wallets and mobile text messages to deliver timely information and financial services to smallholder farmers and citizens. High mobile-penetration rates and digital-friendly attitudes in the developing world present a long-term opportunity to protect incomes and extend targeted support to smallholder farmers.

- **The latest index measures gender inequality for the first time, capturing disparities in health, access to education and labour-market opportunities, and political representation**. While countries in Europe have maintained strong scores in the index period, Gulf Cooperation Council (GCC) countries including Saudi Arabia, Qatar and the United Arab Emirates (UAE) have made significant improvements over the past decade. Even though 90% of the countries in the index have made a positive improvement since 2012, further efforts are needed to fill the large gaps that still remain. There are a few success stories from the agriculture and food sector in the Middle East and Africa, where gender-focused programmes have trained, mentored and supported women researchers and scientists working in food, nutrition and climate change.

- **Understanding the nutritional needs of high-risk groups will require food security to be a top priority on countries' national agenda. However, the GFSI finds that only 54 countries have a national food security strategy in place**. While the number of countries with a food security strategy has increased over the years, there is still a lot of room for improvement. Prioritising food security and focusing on disaggregated data collection can help to further understand the needs of the population at a household and

individual level, allowing for effective comparison of food and nutritional gaps across gender and socio-economic lines. A majority of countries (82 out of 113) in the latest index also lack a dedicated food security agency to help design, prioritise and implement such strategies.

- **The index finds that several countries have made significant improvements in ensuring that their populations have access to essential micronutrients**. European countries have consistently performed well in ensuring access to micronutrients including vitamin A, iron and zinc in diets during the entire index period from 2012 to 2020. Low and lower-middle income countries in Asia, Latin America and Sub-Saharan Africa have seen an improving trend, although there is room for more progress. Governments can move forward by building food value chains such that they also address nutritional gaps. For instance, countries like Bangladesh, Indonesia, El Salvador and Kenya are shaping food value chains in a way that farmers produce food items that are profitable as well as high in nutrition, thus addressing the nutritional needs of certain high-risk groups.

- **The 2020 GFSI incorporates the "Natural Resources and Resilience" category into the main index for the first time, revealing that rising temperatures and failed rains are causing land degradation and crop failures**. Southeast Asian countries including Indonesia, the Philippines, Singapore and Malaysia are exposed to high temperature rises. In Latin America, Ecuador, the Dominican Republic, Peru, Colombia and El Salvador also face high risks from temperature increases, while Uruguay and Argentina are the region's least susceptible countries, as per the latest index. Central Asian countries including Kazakhstan, Uzbekistan and Tajikistan are also less exposed to increasing temperatures. A warmer climate and resulting events are already causing land degradation and desertification, and interrupting the planting season in many countries.[2]

- **Highly volatile agriculture production in countries like Australia, Norway and Sweden demonstrates the risks that climate change poses to agriculture and food production**. Droughts and extreme summer in 2018 in Northern Europe led to the worst crop harvests in about 50 years in Denmark, Norway and Sweden. Both Norway and Sweden's cereal and vegetable production almost halved in 2018. The GFSI finds that agricultural production has become more vulnerable in 49 countries compared to the previous index period.

- **High-income resource-constrained countries like Singapore, Bahrain, Qatar, the UAE and Kuwait face the highest rates of food import dependency**. Countries like the UAE and Singapore are encouraging technological innovation in agriculture to boost their domestic production. The UAE is boosting local food production by supporting ventures in hydroponics, aquaponics and vertical farms. Singapore, which, along with Bahrain, is one of the two most food import-dependent countries, is scaling up local production through vertical farms and investing in alternative proteins, in addition to diversifying its food suppliers. Many wealthier but resource-poor countries have also shifted their trade strategies and domestic policies to diversify their international dependence. Since the first edition of index in 2012, 67 countries have increased their dependency on food

2 FAO. "FAO needs $350 million to avert rising hunger as countries reel from COVID-19 pandemic's impact". 2020. Available at: http://www.fao.org/news/story/en/item/1276081/icode/

imports. Sixteen countries, the majority from Sub-Saharan Africa, have reduced their dependency on food imports.

- **Many countries in Africa and Asia face increasing risk from flooding, which can cause crop loss and lead to a volatile food supply**. Niger, Chad, India, South Korea, Bangladesh and China face some of the most extreme flooding risks. A large number of developing countries, including Bangladesh and India, also face risks of agricultural water contamination, according to the GFSI's agricultural water risk indicator. A combination of public investment and private-sector innovation is enabling countries to prepare for water-related risks. China is adapting by heavily investing in water conservancy projects involving irrigation, flood control and ecological protection. Israel, which faces a risk of agricultural water shortage, is deploying machine learning and smart meters to minimise water leakage and treat wastewater for agriculture use.
- **Policy commitment to adaptation, technological innovation and agriculture R&D can help countries to prepare for the impending environmental risks**. A majority of European countries have deployed early-warning measures for agriculture, made national commitments to manage risk exposure and put in place national climate-change strategies that include agricultural adaptation. Some countries, including Algeria, Belarus, Oman and Russia, have for the first time adopted agriculture climate change adaptation strategies. Developing countries are offering examples of tech-related innovations that can help countries to manage their climate footprints. In Africa, 2m farmers are now growing drought-tolerant maize as a part of the Drought Tolerant Maize for Africa initiative.

Introduction: Turning crisis into opportunity

The covid-19 pandemic has evolved into one of the largest health, economic and social crises in recent history, with hunger and food insecurity a significant consequence. The global food system has been profoundly tested by lockdowns, restrictions on the movement of goods and people, market closures, and workforce shortages.

Although food demand and production have both been disrupted during the pandemic, global food systems were under strain even before covid-19 began to spread, with many countries struggling to increase productivity, adapt to a worsening climate and reduce environmental harm. Despite the overwhelming challenges now imposed on food systems, the crisis has also presented policymakers and the private sector with the opportunity to innovate and create a stronger, more resilient and sustainable food environment going forward.

A key focus must be on overcoming structural inequalities, a fundamental feature of the pandemic. The economic crisis forms a feedback loop: livelihoods are lost, limiting access to affordable food and undermining health, which, in turn, puts people at increased risk of negative health outcomes through poor nutrition and weakened immunity, thus affecting their ability to work and otherwise look after their families. Women are disproportionately hit by income losses and, as a result, a lack of food and nutrition. This has intergenerational consequences, given the link between maternal and child health. In labour markets, informal workers and migrants—key participants in the food production and logistic system—often lack access to government welfare and furlough schemes, which in turn hurts the families that rely on their remittances. Lastly, the world's most disadvantaged states, predominantly in Sub-Saharan Africa and the Middle East, are battling a combination of conflict, poverty and climate pressure.

The covid-19 crisis has underscored and, in some cases, exacerbated long-standing issues in the global food system. However, countries can adopt the right policies and innovations to address these challenges. The pandemic is spurring innovation, agility and public support. Governments have invested unprecedented financial resources to support incomes, including by utilising mobile and digital technology to disburse knowledge and funds. School meals programmes have been adapted into take-home ration schemes and cash-transfer alternatives, including connecting schools to smallholders to simultaneously support food security and farmer incomes. Multilateral organisations have stepped in to provide seeds and agricultural inputs to help farmers avoid losing critical planting windows, and climate-smart agriculture programmes continue to operate across multiple continents, helping to raise output while lowering ecological and emissions impacts.

This report builds upon and substantiates findings from the 2020 Global Food Security Index. It examines the food security dynamics of covid-19 and the ongoing structural shifts, with a thematic focus on inequality across three dimensions—income, gender, and environment and resources. It assesses both current trend-lines and emerging innovations and best practices that could help fix both short-term threats and longer-term weaknesses.

Chapter 1: Income and economic inequality

Protecting the vulnerable from sudden economic shocks to food security

The covid-19 pandemic has exposed existing vulnerabilities in the global food system. Although the various stakeholders have been quick to respond, the lockdown restrictions, and resulting economic fallout, have had a disproportionate impact on those living below the poverty line with limited, if any, social protections. In the agricultural sector, smallholder farmers, the majority of whom reside in rural areas, have suffered a significant loss of income as lockdowns have prevented market access and interrupted the planting season.[3] While the pandemic has affected every country in the world, the extent and scale of this impact has been uneven. Conflict-ridden and fragile states have been the worst affected due to weak political systems, volatile economies and a high dependence on external aid.

Covid-19's impact on the vulnerable is evident. The decline in global poverty had, even prior to the pandemic, been gradually slowing.[4] Any slowdown in poverty reduction immediately equates to a slowdown in food security progress, as lower-income households spend a proportionately larger share of their income on food. The 2020 edition of the GFSI shows the proportion of people living below the poverty line, defined as US$3.20/day at 2011 purchasing power parity (PPP), reduced between 2012 and 2018 but barely changed in 2019, with 92 countries posting no improvement and eight countries showing an increase in poverty levels. Moreover, the pandemic is likely to reverse gains made in reducing poverty over the past few decades, increasing global poverty for the first time since 1998.[5]

Examining absolute poverty rates alongside inequality in incomes can tell a deeper story. For the first time, the 2020 edition of the GFSI also incorporates income and standard of living through the lens of inequality-adjusted income levels, which measure per capita income after adjusting for national inequality levels. Although countries in Sub-Saharan Africa have the lowest levels of inequality-adjusted income, some, such as Rwanda, Mozambique and Congo, have made marginal improvements. However, inequality-adjusted income has deteriorated in 24 countries and showed no improvement in a further 14 out of the 113 countries in the index. On the other hand, unsurprisingly, 11 of the top 15 countries in terms of inequality-adjusted income levels are from Western Europe. High income levels, coupled with relatively low rates of inequality in Europe, indicate more equitable access to resources and better ability to cope with the unexpected economic shocks that can drive food insecurity, particularly for the most vulnerable in times of crises.

3 FAO. "FAO needs $350 million to avert rising hunger as countries reel from COVID-19 pandemic's impact". 2020. Available at: http://www.fao.org/news/story/en/item/1276081/icode/

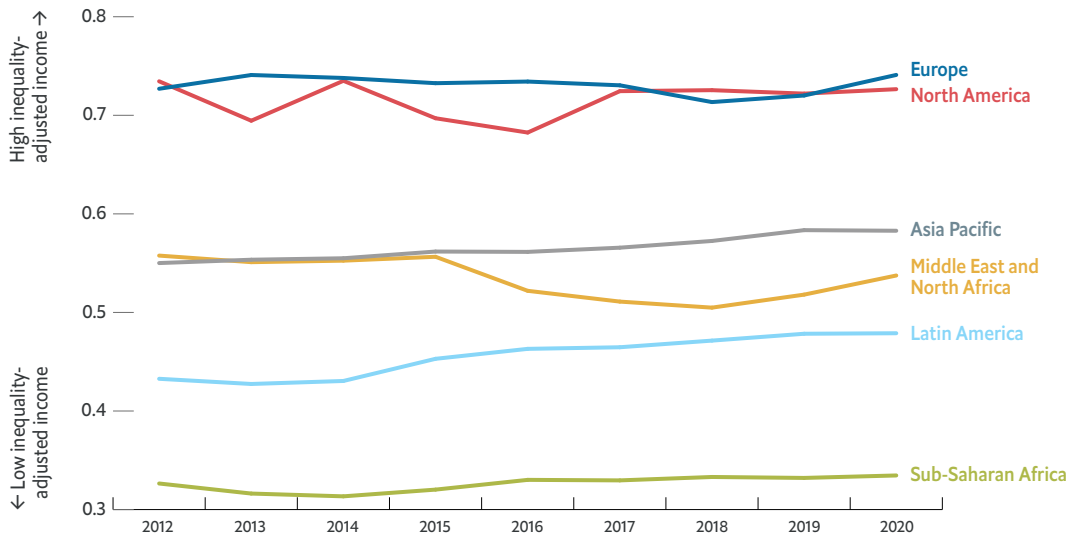
4 World Bank. "Decline of global poverty continues but has slowed". 2019. Available at: https://www.worldbank.org/en/news/press-release/2018/09/19/decline-of-global-extreme-poverty-continues-but-has-slowed-world-bank

5 World Bank. "The impact of COVID-19 (Coronavirus) on global poverty: Why Sub-Saharan Africa might be the region hardest hit." 2010. Available at: https://blogs.worldbank.org/opendata/impact-covid-19-coronavirus-global-poverty-why-sub-saharan-africa-might-be-region-hardest

Figure 1
Inequality-adjusted income index

The inequality-adjusted income index is a metric produced by the UN Development Programme (UNDP) that adjusts for inequality while measuring the individual income levels in a country. A score of 0 implies lowest income after adjusting for inequality levels and a score of 1 means highest income after accounting for inequality.

Index score 0–1



Source: UN Development Programme.

Conflict states suffer the worst impacts of poverty and political instability on food security

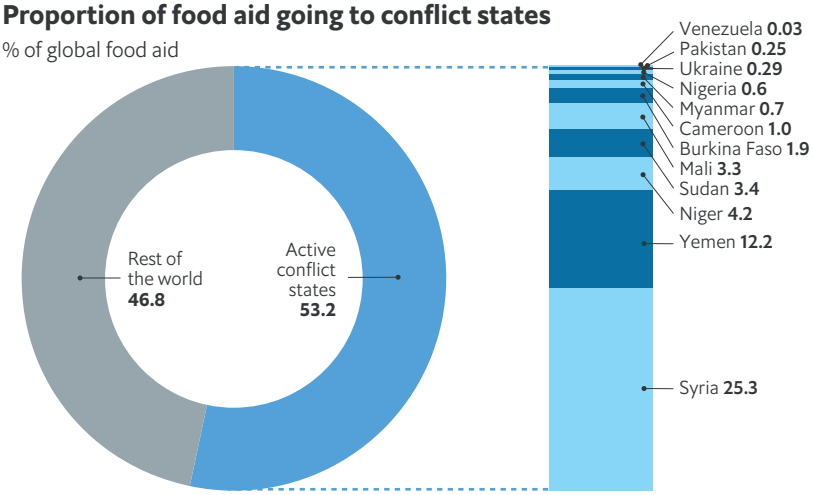
Extreme poverty, political instability, violence and volatile food prices mean that populations living in conflict zones are particularly vulnerable to acute food insecurity. In recognition of these interacting forces, this year's GFSI incorporates armed conflict into the index.

As measured in this year's index, nine countries have experienced sharply changing food costs in the average basket of food products and a majority (61) experienced deterioration relative to the previous year. The lowest-scoring countries are predominantly low-income Sub-Saharan African countries, but two of the three—Venezuela and Syria—reflect the impact of conflict and political instability on the food system. An estimated one in three Venezuelans are currently food insecure, and many families have only avoided food insecurity by sacrificing assets.[6] The GFSI also highlights several conflict-affected countries that are suffering an acute dependence on chronic food aid, including Burkina Faso, Niger, Syria and Yemen. Six countries (Madagascar, Uganda, Cameroon, El Salvador, Nigeria and Benin) have experienced a much higher dependency on chronic food aid compared with the 2017 index. The UN Food and Agriculture Organisation (FAO) has also identified 27 food insecurity hotspots that are headed towards crisis as a result of the pandemic being overlaid on existing food insecurity dynamics.[7] The majority of these are active conflict zones.

6 Relief Web. "WFP Venezuela Food Security Assessment Main Findings | Data Collected between July and September 2019". 2020. Available at: https://reliefweb.int/report/venezuela-bolivarian-republic/wfp-venezuela-food-security-assessment-main-findings-data

7 FAO. "New report identifies 27 countries heading for COVID-19-driven food crises". 2020.Available at: http://www.fao.org/news/story/en/item/1298468/icode/

Figure 2
Proportion of food aid going to conflict states
% of global food aid



Source: Global Food Security Index 2020.

Migrants and informal workers in urban areas are particularly vulnerable to food insecurity resulting from economic shocks

Migrants and informal workers, who make up almost two-thirds (62%) of the global workforce, have been hit hard by the pandemic in terms of lost salaries, employment contracts and labour protections.[8] Informal employment comprises work that is not registered, regulated or protected by existing legal or regulatory frameworks, as well as non-remunerative work in an income-generating enterprise.[9] Informal workers' incomes declined by 60% in the first month of the pandemic, with the expected decline largest in Africa and Latin America, at 81%.[10] Many migrants and informal workers, residing in urban areas, are facing a loss of livelihood and relatively higher food prices, leaving them extremely vulnerable to food insecurity.[11] To mitigate the impact of job losses and higher food costs, governments are focusing on improving social protections and targeting income support for the poorest and those at risk.

Strengthening food safety nets is one approach. Safety net programmes can protect the poor and vulnerable when crisis hits. However, when they are underfunded, they can put millions at risk. The latest index finds that food safety nets remain limited in coverage or are not sufficiently resourced to weather a pandemic in many countries. All but three countries in the GFSI (Democratic Republic of Congo, Syria and Yemen) have some sort of food safety net in place, but funding for these programmes is currently insufficient in 47 countries, and 36 countries do not have national coverage (Figure 3).

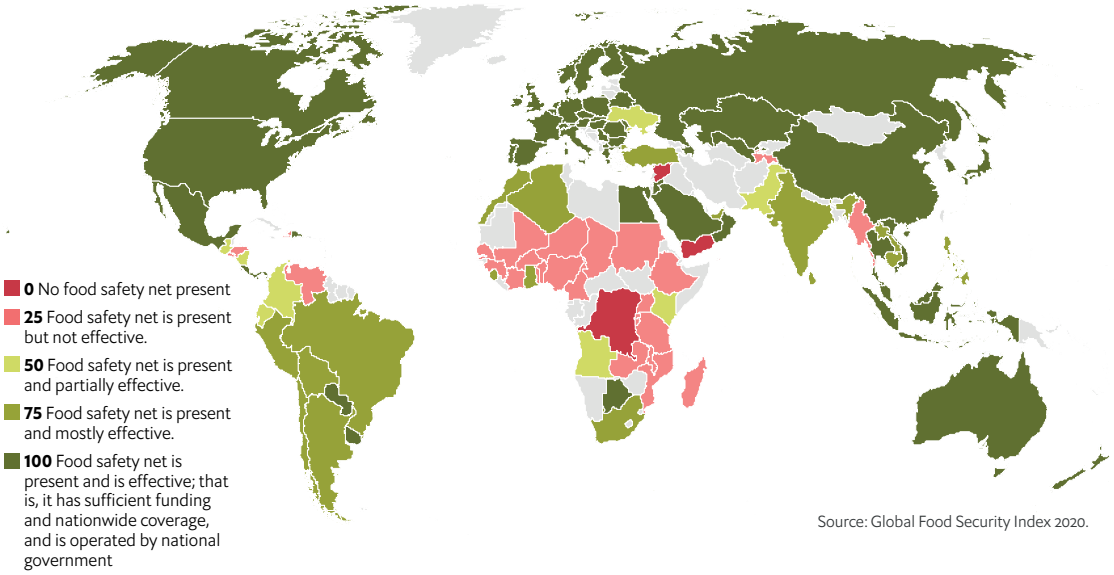
8 International Labour Organisation. "COVID-19 crisis and the informal economy Immediate responses and policy challenges". 2020. Available at: https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/briefingnote/wcms_743623.pdf

9 International Labour Organisation. "Minimum wage policy guide". 2020. Available at: https://www.ilo.org/global/topics/wages/minimum-wages/beneficiaries/WCMS_436492/lang--en/index.htm#:~:text=By%20doing%20so%2C%20they%20defined,in%20an%20income%2Dproducing%20enterprise

10 International Labour Organisation. "ILO Monitor: COVID-19 and the world of work. Third edition Updated estimates and analysis". Available at: 2020. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_743146.pdf

11 UN. "Policy Brief: The Impact of COVID-19 on Food Security and Nutrition". 2020. Available at: https://www.tralac.org/documents/resources/covid-19/3813-the-impact-of-covid-19-on-food-security-and-nutrition-un-policy-brief-june-2020/file.html

Figure 3
Food safety nets across the world
Presence, funding, coverage and operation of food safety net programmes, 0-100
0= no food safety net programme, 100= sufficiently funded, government operated national-level food safety programme



Source: Global Food Security Index 2020.

Policymakers have responded by targeting cash transfers using digital technologies

Governments have initiated unprecedented financial aid programmes over the past year to cushion people from the income-related shocks of the pandemic. Cash transfers have been a dominant approach to protecting incomes.[12] Several countries, including Bangladesh, Brazil, China, India and Italy, have also recently made efforts to include a basic income guarantee in their social protection measures.

Some government-to-person (G2P) payment programmes have used digital technologies to disburse funds and adjust stimulus spending. In Hangzhou, China, municipal authorities worked with Alibaba, an e-commerce firm, to launch a digital coupon stimulus programme via the company's Alipay platform. Malaysia's federal government disbursed US$110m to nearly half the population via three e-wallet platforms (Grab, Boost, and Touch 'n Go).[13,14]

Because food spending constitutes a larger share of spending among the poor, these interventions have substantially reduced the adverse nutritional impacts of the crisis. Governments in emerging economies can further benefit from such digital initiatives to improve financial inclusivity by exploiting high rates of mobile penetration to facilitate instant payments and enable traceability of transactions.

12 Gentilini U, Almenfi M, Dale P, Lopez AV, Zafar U. "Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures." 2020. Available at: http://documents1.worldbank.org/curated/en/454671594649637530/pdf/Social-Protection-and-Jobs-Responses-to-COVID-19-A-Real-Time-Review-of-Country-Measures.pdf

13 Luohan Academy. "How Digital Coupons Fuel China's Economic Recovery". 2020. Available at: https://www.luohanacademy.com/insights/e0d638c3f840e3be

14 Nikkei Asia. "Malaysia to disburse cash to help boost digital payments". 2020. Available at: https://asia.nikkei.com/Business/Finance/Malaysia-to-disburse-cash-to-help-boost-digital-payments

Smallholder farmers face uncertainty in accessing inputs and markets amid the covid-19 pandemic

The FAO estimates that 80% of the world's poor and food insecure live in rural areas, and most of the world's rural poor are small-scale family food producers.[15] The majority are located in Asia and Sub-Saharan Africa.[16]

The pandemic is restricting smallholder farmers' access to markets in ways that will impact agricultural production and incomes going forward. Lockdowns and disrupted supply chains have prevented farmers from accessing fields, selling produce or buying inputs.[17] In Latin America and the Caribbean, the impact of the pandemic between April and June coincided with the planting season for critical crops. A lack of access to fields and agricultural inputs can lead to the farmers missing the planting season.[18] In eastern Africa, covid-19 restrictions curbed air freight imports and aerial spray operations of pesticides at a time when heavy swarms of locusts ravaged fields during planting season.

Smallholder farmers are more susceptible to food shortages and nutritional deficiencies owing to the fact that loss of income prevents them from purchasing nutritious food.[19] Some governments are stepping in to mitigate the risks inherent in food systems by increasing income and social protection, and funding for food safety nets, as well as stabilising agricultural production, procuring directly from smallholders or associations, absorbing surpluses, and preventing the loss of perishable foods.

Governments in some countries—China, Italy and Brazil, for example—have responded positively to address the adverse effects of the pandemic by increasing smallholder farmers' access to credit (and to seeds and fertilisers at subsidised prices).[20] Examples of direct cash support include a one-time payment of Rs2000 (US$27) for the 87m farmer beneficiaries of India's Pradhan Mantri Kisan Samman Nidhi (PM-Kisan) programme.[21] Mexico's Sembrando Vida programme, which provides rural employment, has expanded to 200,000 farmers.[22]

15 Committee on World Food Security. "Connecting smallholders to markets". 2019. Available at: http://www.fao.org/cfs/home/activities/smallholders/en/

16 Cheong M. "Smallholder farmers, our future". AP Food Online. 2017. Available at: .https://apfoodonline.com/industry/smallholder-farmers-our-future/

17 UN. "Policy Brief: The Impact of COVID-19 on Food Security and Nutrition". 2020. Available at: https://www.tralac.org/documents/resources/covid-19/3813-the-impact-of-covid-19-on-food-security-and-nutrition-un-policy-brief-june-2020/file.html

18 FAO. "FAO needs $350 million to avert rising hunger as countries reel from COVID-19 pandemic's impact". 2020. Available at: http://www.fao.org/news/story/en/item/1276081/icode/

19 Reliefweb. "Hundreds of millions of family farmers in Asia-Pacific need help to ensure food security in the face of pandemic". 2020. Available at: https://reliefweb.int/report/world/hundreds-millions-family-farmers-asia-pacific-need-help-ensure-food-security-face

20 FAO. "COVID-19 and smallholder producers' access to markets". 2020. Available at: http://www.fao.org/3/ca8657en/CA8657EN.pdf

21 Gentilini U, Almenfi M, Dale P, Lopez AV, Mujica IV, Quintana R, Zafar U. "Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures". 2020. Available at: .https://www.ugogentilini.net/wp-content/uploads/2020/06/SP-COVID-responses_June-12.pdf

22 Hogewoning J. "Sembrando Vida Now Part of COVID-19 Strategy." Mexico Business. 2020. https://mexicobusiness.news/agribusiness/news/sembrando-vida-now-part-covid-19-strategy

Governments have deployed digital tools and technologies to provide timely information to farmers during the pandemic. These solutions can support broader, long-term goals such as financial inclusion of smallholder farmers

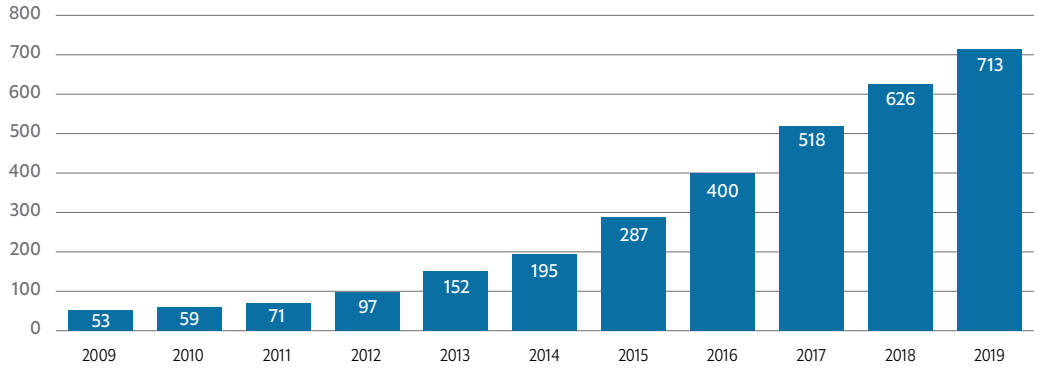
A large number of smallholder farmers reside in developing countries where mobile phones have become pervasive and affordable. Mobile technology can be a useful tool to provide timely information, targeted agriculture advice and digital services to those who currently lack access to such services. Improved access to food market data and mobile banking has provided the underlying enabling infrastructure, with the 2020 GFSI showing improved levels of access in 63 countries.

As a result of higher mobile penetration and better infrastructure, digital agriculture services have soared in the past decade (Figure 4). Digital advisory services, covering areas including agricultural knowledge, weather predictions and market pricing, have become the most prevalent. These services often rely on basic text-message and voice channels to provide advice to farmers.[23] Smallholder farmers, in particular, often have limited access to information, markets, capital and inputs like fertilisers and seeds. The transmission of agricultural information through mobile technologies in Sub-Saharan Africa and India has increased yields by 4% and the odds of adoption of recommended agrochemical inputs by 22%.[24]

Figure 4

Active digital agriculture services over the years

Number of active digital agriculture services globally



Source: Global System for Mobile Communications Association.

23 GSMA. "Digital Agriculture Maps: 2020 State of the Sector in Low and Middle-Income Countries". 2020. Available at: https://www.gsma.com/r/wp-content/uploads/2020/09/GSMA-Agritech-Digital-Agriculture-Maps.pdf

24 Fabregas R, Kremer M, Schilbach F. "Realizing the potential of digital development: The case of agricultural advice". 2019. Available at: https://science.sciencemag.org/content/366/6471/eaay3038

In Ghana, educational awareness campaigns have used mobile text and voice messages to inform smallholders about the pandemic in their local language. Margaret Addai, a cocoa farmer in Bipoa, in the Ashanti Region, who received messages in her local language, Twi, said that such messages are crucial for farmers. Without them, she told Farmerline, a local NGO, she would not have been aware of the risks of covid-19.[25]

Technology is also helping to provide digital financial services and enable financial inclusion in agriculture. Since 2014, One Acre Fund, a non-profit organisation, has enabled farmers in Kenya to make loan repayments digitally using M-Pesa, a mobile money service, instead of using cash, thus increasing economic opportunity and financial inclusion in some of the world's poorest farming communities. This has yielded an 85% reduction in market leakage, with 100% of farmers claiming to prefer digital over physical payments thanks to increased convenience and transparency, according to a 2017 report.[26]

To prevent the pandemic interrupting planting, the FAO has supported farmers in climate-stressed areas through measures including seed distribution in Haiti and Sudan.[27] It has also deployed e-vouchers via SMS to help Somali farmers access seeds, tools and irrigation services.[28,29] The pandemic has highlighted the need to further strengthen and solidify digital infrastructure. It can not only cut costs, but also prevent payment leakages in countries struggling with levels of high corruption.

25 Farmerline. "COVID-19; how we are working to keep farmers and employees safe". 2020. Available at: https://farmerline.co/2020/04/06/covid-19-how-we-are-working-to-keep-farmers-and-employees-safe/

26 Better than Cash Alliance. "How Digitizing Agricultural Input Payments in Rural Kenya Is Tackling Poverty: The Case of One Acre Fund". 2017. Available at: https://btca-prod-1.s3.amazonaws.com/documents/287/english_attachments/RuralKenyaIsTacklingPovertyCaselet.pdf?1495717431

27 FAO. "FAO needs $350 million to avert rising hunger as countries reel from COVID-19 pandemic's impact". 2020. Available at: http://www.fao.org/news/story/en/item/1276081/icode/

28 FAO. "Reviving agricultural production in Haiti in the context of multiple crises". 2020. Available at: http://www.fao.org/emergencies/resources/photos/photo-detail/en/c/1287433/

29 FAO. "FAO seeds distribution in South Sudan during COVID-19: A young female farmer receives quality seeds for the planting season". 2020. Available at: http://www.fao.org/emergencies/fao-in-action/stories/stories-detail/en/c/1273756/

E-commerce players are supporting smaller businesses and connecting farmers directly with consumers

The covid-19 pandemic has brought forth significant innovation from tech companies and large food enterprises to help food reach consumers. In populous countries like China, India and Nigeria, e-commerce giants moved to a hyperlocal delivery model (matching online customers to local offline shops) by connecting with small and medium-sized retailers.[30,31] By enabling retailers of any size to set up digital channels, e-commerce platforms are bringing long-term positive implications for market efficiency. In Thailand, local restaurants are now selling food directly to consumers via Facebook, avoiding the large fees charged by some food delivery apps.[32]

Some tech companies are also helping smaller producers to manage the supply shock. For example, Swiggy, an Indian food delivery app, introduced a capital assist programme to help its partners pay for hygiene and social distancing upgrades.[33] In Singapore, Unilever partnered with an e-commerce platform to connect food and drink firms to local diners. The company has also begun to provide credit and advance payments to small and medium-sized vendors.[34,35]

Elsewhere, food industry associations and bodies are helping supply chains to recalibrate and re-organise. The China Agricultural Wholesale Market Association is one exemplar of this, working with e-commerce and mobile messaging platforms to link suppliers and buyers.[36] Similarly, the Myanmar Pulses, Beans and Sesame Seeds Merchants Association has formed an e-platform to link suppliers, processors and exporters, and India's National Informatics Centre has created Kisan Rath, a mobile app designed to help farmers and traders find vehicles to transport their produce to market.[37]

30 Economic Times. "Flipkart preparing to start hyperlocal delivery services: Sources". 2020. Available at: https://retail.economictimes.indiatimes.com/news/e-commerce/e-tailing/flipkart-preparing-to-start-hyperlocal-delivery-services-sources/76416609

31 Kazeem Y. "African e-commerce is getting a much needed boost from coronavirus lockdowns". Quartz Africa. 2020. Available at: https://qz.com/africa/1855227/africas-e-commerce-boosted-by-coronavirus-lockdowns/

32 Leesa-Nguansuk S. "Covid-19: Thailand eateries banking on delivery apps, social media to survive lockdown". The Star. 2020. Available at: https://www.thestar.com.my/tech/tech-news/2020/04/21/covid-19-thailand-eateries-banking-on-delivery-apps-social-media-to-survive-lockdown

33 India Retailing. "Swiggy launches initiative to help restaurants jumpstart operations". 2020. Available at: https://www.indiaretailing.com/2020/06/17/food/food-service/swiggy-launches-initiative-to-help-restaurants-jumpstart-operations/

34 Unilever. "Covid-19 support: From Singapore to Slovakia, Bangladesh to Brazil". 2020. Available at: .https://www.unilever.com/news/news-and-features/Feature-article/2020/covid-19-support-from-singapore-to-slovakia-bangladesh-to-brazil.html

35 The Economist. "How Alan Jope runs Unilever from his study". 2020. Available at: https://www.economist.com/business/2020/03/26/how-alan-jope-runs-unilever-from-his-study

36 FAO. "Local food systems and COVID-19: A look into China's responses". Available at: http://www.fao.org/in-action/food-for-cities-programme/news/detail/en/c/1270350/

37 Financial Express. "Kisan Rath Mobile App: Centre launches new app to help farmers during coronavirus lockdown". 2020. Available at: https://www.financialexpress.com/industry/technology/kisan-rath-mobile-app-features-benefits-of-app-to-help-farmers-during-coronavirus-lockdown/

Chapter 2: Gender inequality

Empowering women to overcome food and nutritional insecurity

Social status affects all aspects of food security, from income to decision-making power. Women, minorities and children are generally at a disadvantage when it comes to food security and nutrition in countries with higher levels of inequality owing to limits to their autonomy and lack of control over their nutrition. In addition, economic crises tend to have more serious impacts on women. For instance, the 2007-08 global food price crisis, when food prices increased dramatically, disproportionately affected women in agriculture (the same is true of a second price spike, in 2010-11); this was due to discrimination in land rights and lack of access to productive resources such as credit, among other structural issues.[38] The covid-19 pandemic is worsening inequalities along gender, age, race and ethnic lines, with direct implications for food security. Identifying disadvantaged groups through data-driven policies and implementing targeted social protection mechanisms can protect those whose social standing puts them at a disadvantage, especially during a food crisis.

Women carry a disproportionate share of the food insecurity burden

This year's GFSI includes a gender inequality indicator for the first time, capturing inequality in health, access to education and labour market opportunities, and political representation. The index finds that nearly 90% of countries have made progress towards ensuring gender equality since 2012, but there are large differences. Saudi Arabia has achieved the largest improvement, followed by other countries in the Middle East, including Qatar, Egypt and Turkey. High-income countries in Europe have performed the strongest, with the top eight countries all being European, led by Switzerland. South Korea and Singapore are also strong performers, ranking 9th and 10th respectively. Eight of the bottom ten are countries in Sub-Saharan Africa; they are joined by Haiti and Yemen.

The covid-19 pandemic could undermine some of the progress made. Covid-adjusted forecasts by the UN indicate that women will be more affected by the shift into extreme poverty, defined internationally as people living on less than US$1.90/day, with the number of women living in extreme poverty expected to reach 247m by 2021, compared with 236m men.[39,40]

In terms of employment, women are over-represented in sectors where workers face a higher risk of infection, such as essential services, and sectors over-exposed to economic shocks. In Bangladesh, women make up 80% of the workers in ready-made garment production, a sector that in 2020 has suffered from falling demands due to disrupted global supply chains.[41] This decline in demand has come on top of existing legal and socio-economic barriers. According to a World Bank report, an estimated 155 countries have at least one law restricting women's economic opportunities, and 100 exclude women altogether from working in

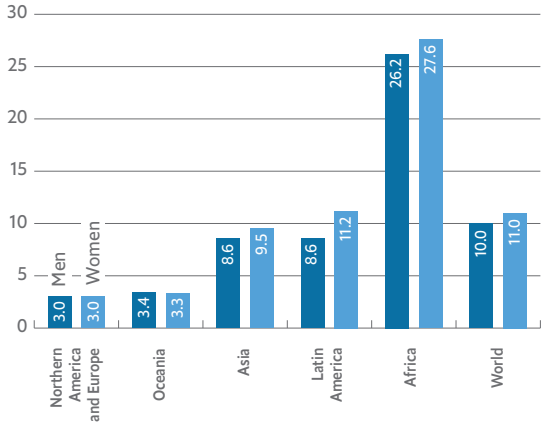
38 Reliefweb. "Gender Inequalities and Food Insecurity: Ten years after the food price crisis, why are women farmers still food-insecure?". 2019. Available at: https://reliefweb.int/report/world/gender-inequalities-and-food-insecurity-ten-years-after-food-price-crisis-why-are-women

39 The World Bank's international poverty line for extreme poverty is set at US$1.90 per day. The GFSI uses a slightly higher measure, the World Bank's poverty line (US$3.20 per day at 2011 international dollars), to report poverty rates to include people who remain vulnerable to economic shocks and often struggle with food insecurity. This higher poverty line was introduced by the World Bank in 2018.

40 UN Women. "From insight to action: gender equality in the wake of covid-19". 2020. Available at: https://www.unwomen.org/-/media/headquarters/attachments/sections/library/publications/2020/gender-equality-in-the-wake-of-covid-19-en.pdf?la=en&vs=5142

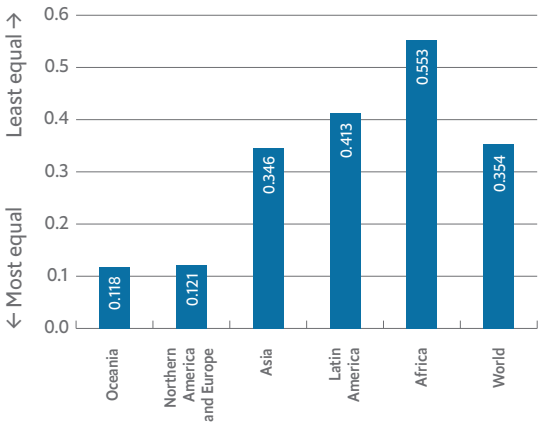
41 WTO. "The economic impact of covid-19 on women in vulnerable sectors and economies". 2020. Available at: https://www.wto.org/english/news_e/news20_e/info_note_covid_05aug20_e.pdf

Figure 5
Percentage of men and women suffering from severe food insecurity by region* in 2020



Sources: FAO, International Fund for Agricultural Development, UNICEF, World Food Programme, World Health Organisation (WHO).

Figure 6
Gender inequality by region* in 2020
(0– 1)



Source: UN Development Programme.

* Countries included in the regional groups: **Oceania** – Australia and New Zealand. **Africa** – Rwanda, South Africa, Botswana, Ethiopia, Burundi, Senegal, Uganda, Tanzania, Zambia, Ghana, Kenya, Sudan, Cameroon, Togo, Mozambique, Madagascar, Angola, Guinea, Nigeria, Burkina Faso, Benin, Malawi, Sierra Leone, Niger, Congo (Dem. Rep.), Côte d'Ivoire, Mali, Chad, Tunisia, Algeria, Egypt and Morocco. **Asia** – South Korea, Singapore, Japan, China, Kazakhstan, Malaysia, Uzbekistan, Vietnam, Azerbaijan, Tajikistan, Thailand, Sri Lanka, Philippines, Indonesia, Myanmar, Laos, Cambodia, Nepal, India, Bangladesh and Pakistan. Countries included in **North America, Europe** and **Latin America** are the same as the Global Food Security Index (GFSI).

certain jobs.[42] A lack of access to education and employment limits financial independence and bargaining power, which often results in women being underpaid.

At the household level, women, who largely shoulder the burden of providing food, are often the first to face food insecurity.[43] In developing countries, women are more likely to be malnourished and nutrient deficient than men. Data from 2016 show that, globally, 15% of women are obese, compared with 11% of men.[44] This is because women have a higher tendency to resort to cheap foods that have little nutritional value.[45] Several of the countries in the GFSI that perform poorly on gender equality—such as Yemen, Sierra Leone, Haiti and Malawi—also sit at the bottom of the food security rankings.

Some governments and public agencies are taking measures to support at-risk social groups, such as through the expansion or implementation of cash transfers to women. Egypt has expanded the Takaful and Karama cash-transfer programme, for which 88% of beneficiaries are women, and plans increased payments to women leaders in rural communities. Burkina Faso has a cash-transfer programme worth US$10m to help fruit and vegetable sellers in the informal sector, with a focus on women.[46] In Togo, a digital cash-transfer programme, Novissi, provides monthly aid of US$21 for women and US$19 for men to informal sector workers; the project was assembled in just ten days, using the national voter database, to serve around 12% of the population.

42 World Bank. "Women, business and the law". 2016. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/22546/9781464806773.pdf?sequence=3&isAllowed=y.

43 Oxfam. "Gender inequalities and food insecurity". 2019. Available at: https://oxfamilibrary.openrepository.com/bitstream/handle/10546/620841/bp-gender-inequalities-food-insecurity-150719-en.pdf

44 WHO. "Obesity and overweight". 2020. Available at: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

45 Bridge. "Gender and Food Security: towards gender-just food and nutrition security". 2014. Available at: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/5245/IDS_Bridge_Food_Security_Report_Online.pdf?sequence=3

46 Gentilini U, Almenfi M, Dale P, Lopez AV, Zafar U. "Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures." 2020. Available at: http://documents1.worldbank.org/curated/en/454671594649637530/pdf/Social-Protection-and-Jobs-Responses-to-COVID-19-A-Real-Time-Review-of-Country-Measures.pdf

Increasing women's participation in agricultural R&D will provide a long-term solution to gender disparities in the sector

Gender equality should not just be viewed in terms of women as beneficiaries of support—efforts are also underway to promote female representation in agricultural research and development (R&D) as a long-term solution. Including women in profitable and innovative initiatives can not only improve their bargaining power but can also change cultural attitudes and reduce inertia towards gender inclusion in different parts of the sector.[47]

The African Women in Agricultural Research and Development (AWARD) has supported over 1,000 women researchers from 16 African countries in their attempts to tackle problems facing agricultural producers in the continent, where women enable the bulk of food supply chains but represent only 22% of agricultural scientists.[48,49] AWARD has also launched the One Planet Fellowship on climate science, with female fellows comprising over half of its first cohort.[50] The programme will train over 600 African and European scientists in applying gender analyses to find ways that African farmers can adapt to climate change.

Another initiative is the Arab Women Leaders in Agriculture (AWLA) fellowship programme, which recently completed its first year with a cohort of 22 women scientists from six Middle Eastern and North African countries.[51] The fellowship provides training and mentorship to Arab women working in food, nutrition and water security research. According to data from eastern and southern Africa, women are especially underrepresented in agricultural science management positions and post-graduate degree programmes.[52] However, women do make up a higher share of students than researchers in the field, suggesting a narrowing of the gender imbalance in the talent pipeline.

47 FAO. "Empowering rural women, powering agriculture. FAO's work on gender". 2018. Available at: http://www.fao.org/3/ca2678en/CA2678EN.pdf

48 AWARD. Available at: https://awardfellowships.org/

49 Kamau-Rutenberg W. "Gender equality in African agriculture: An innovation imperative". WIPO Magazine. 2019. Available at: https://www.wipo.int/wipo_magazine/en/2019/si/article_0009.html

50 https://www.reuters.com/article/us-climate-change-africa-women/women-step-forward-in-push-to-nurture-african-climate-scientists-idUSKBN1ZC0MJ

51 Wheat. "First cohort of Arab Women Leaders in Agriculture graduates". 2020. Available at: https://wheat.org/tag/arab-women-leaders-in-agriculture/

52 Beintema N. ASTI in Retrospect 01. "The role of women in agricultural research". 2020. Available at: https://asti.cgiar.org/sites/default/files/pdf/asti20/ASTIat20-Gender.pdf

School closures increase the risk of hunger among children

Children also suffer when women face inequalities in access to food and nutrition. Food insecurity and poor nutrition among women during pregnancy is one way in which children are affected, and poor nutrition during infancy and childhood is closely linked to the prevalence of obesity and non-communicable diseases in adulthood.[53] In 2019, 38m children worldwide (5.6% of the total) were obese, while 47m children were affected by acute undernutrition, a condition caused by limited nutrition intake. The 2020 GFSI finds that Sub-Saharan Africa faces the worst levels of undernourishment. As much as

53 FAO, African Union Commission. "Leaving no one behind: a regional outlook on gender and agrifood symptoms - Africa". 2020. Available at: http://www.fao.org/3/cb1086en/CB1086EN.pdf

30-42% of the population in countries like Madagascar, Chad, Rwanda, and Mozambique are undernourished. In the same region, 70% of youths (defined by the FAO as those aged 15-24) are classed as 'working poor', with many working in the informal rural sector.[54,55] There have also been reports of the covid-19 pandemic reversing several years of progress on child labour in several poor countries.[56]

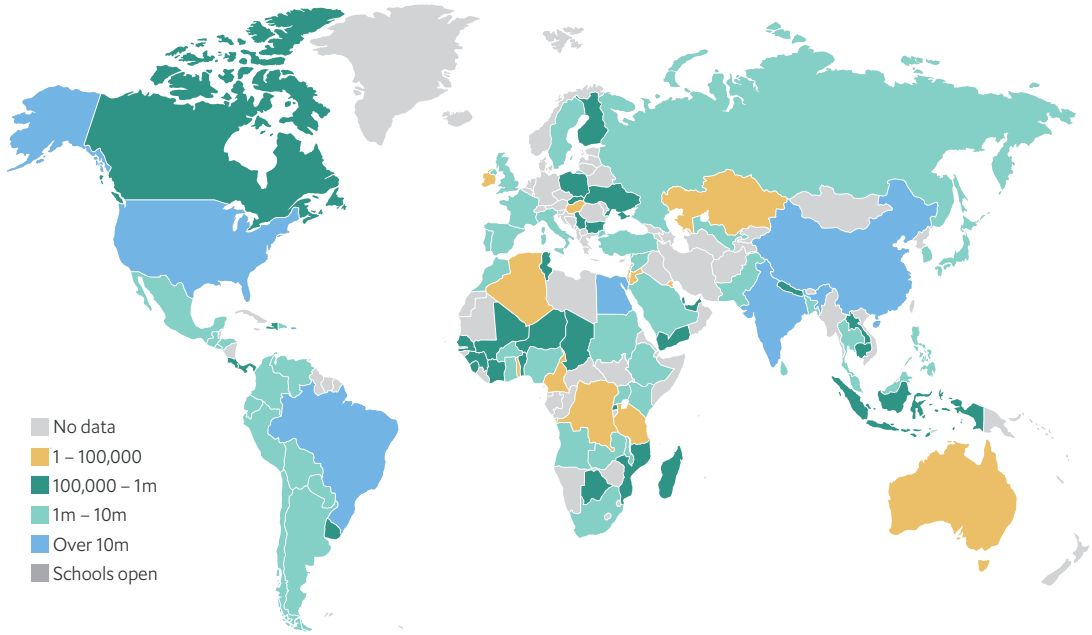
Adapted school meals programmes have become critical to ensuring that children are able to access food and adequate nutrition during the pandemic. School meals are a vital source of nutrition throughout the world—a total of 44 governments have taken ownership of school meals programmes since 1990.[57] By mid-2019, around 310m children in low and middle-income countries were being fed a daily meal at school; this included more than 100 million children in India, 48 million in Brazil, 44 million in China and 9 million each in South Africa and Nigeria.[58] In developed countries including the US, Japan and the UK, millions of disadvantaged children have benefited from school meals programmes.[59]

The covid-19 pandemic has had an impact on the nature of school meals programmes. According to research from the World Bank, governments have adapted and reconfigured

Figure 7

Missed school meals during covid-19 school closures in April 2020

Number of children who missed school meals in different countries during the month of April 2020 (school closure peak) as a result of covid-19



Source: World Food Programme.

54 FAO. "Covid-19 response: inclusion of rural youth in Sub-Saharan Africa". 2020. Available at: http://www.fao.org/support-to-investment/news/detail/en/c/1275405/

55 FAO. "SARD and children and youth". 2007. Available at: http://www.fao.org/3/a-ai520e.pdf

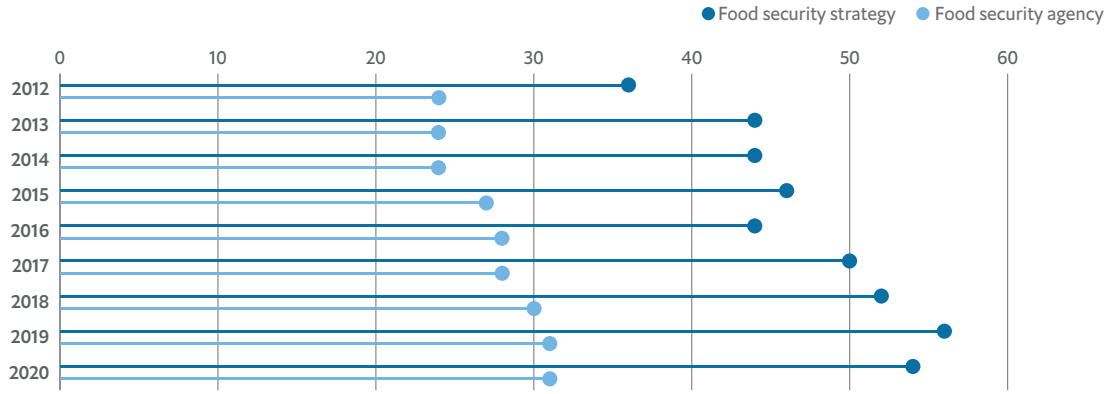
56 International Labour Organisation. "COVID-19 impact on child labour and forced labour: The response of the IPEC+ Flagship Programme". 2020. Available at: http://www.ilo.org/wcmsp5/groups/public/---ed_norm/---ipec/documents/publication/wcms_745287.pdf

57 UN World Food Programme. "School feeding". 2020. Available at: https://www.wfp.org/school-meals

58 UN World Food Programme. "The impact of school feeding programmes". 2019. Available at: https://www.wfp.org/publications/impact-school-feeding-programmes

59 Zenebe M, Gebremedhin S, Henry CJ, et al. "School feeding program has resulted in improved dietary diversity, nutritional status and class attendance of school children". Ital J Pediatr. 44, 16: 2018. Available at:. https://ijponline.biomedcentral.com/articles/10.1186/s13052-018-0449-1

Figure 8
The presence of food security strategies and agencies
Number of countries with a food security strategy and agency



Source: Global Food Security Index 2020.

school meals initiatives over the past year with in-kind or food voucher and school feeding and ration programmes operating in 96 out of 176 countries by July 2020.[60] India's midday meal programme has continued throughout the pandemic, albeit with distribution difficulties, reaching 100m children per day, while Bolivia and Costa Rica adapted national school feeding programmes to provide take-home rations.[61,62]

High-income countries have also taken school meals programmes seriously. In Japan, the Osaka Municipal Government is providing free lunches for all students attending public primary and elementary schools in the city to cushion the financial burden on families due to the pandemic.[63]

Data-driven food security strategies can help to identify the needs of those at risk

Overarching food security strategies, and investments in data, are critical to ensuring balanced progress across whole populations; the GFSI finds much room for progress here. The index finds that only 54 countries have a food security strategy and 31 currently have a food security agency in operation (Figure 8). A food security strategy can help to identify the needs of vulnerable groups and prioritise food security in the national agenda, and a dedicated agency plays an important role in the execution and implementation of such a strategy. As governments try to improve the nutritional status of their populations, examining how food and nutritional security differs across social groups should also be a priority.

The covid-19 pandemic is further expected to exacerbate nutritional deficiencies in high-risk groups such as women and children. This is because food purchase patterns may shift from healthier foods to more affordable ones with longer shelf lives and lower nutritional value. Diets that lack essential nutrients can lead to

60 Gentilini U, Almenfi M, Dale P, Lopez AV, Zafar U. "Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures." 2020. Available at: http://documents1.worldbank.org/curated/en/454671594649637530/pdf/Social-Protection-and-Jobs-Responses-to-COVID-19-A-Real-Time-Review-of-Country-Measures.pdf

61 Reliefweb. "WFP India -Making the mid-day meals functional following school re-opening - COVID-19 Response". 2020. Available at: https://reliefweb.int/report/india/wfp-india-making-mid-day-meals-functional-following-school-re-opening-covid-19-response

62 Scott S, Menon P, Yunus S, Parajuli B. "Nourishing children and adolescents in India: how is India's mega school meal program coping with covid-19?". IFPRI South Asia. 2020. Available at: http://southasia.ifpri.info/2020/06/01/nourishing-children-and-adolescents-in-india-how-is-indias-mega-school-meal-program-coping-with-covid-19/

63 UN World Food Programme. "A country-by-country compilation of measures taken to address the loss of school meals caused by COVID-19 school closures". 2020. Available at: https://insight.wfp.org/a-country-by-country-compilation-of-measures-taken-to-address-the-loss-of-school-meals-caused-by-6d4ef7849e19

serious health consequences; for instance, zinc deficiency can weaken immune function (in the process contributing to 116,000 child deaths per year).[64] The GFSI finds that European countries are strong performers in ensuring dietary access to micronutrients including vitamin A, iron and zinc, while low and lower-middle income countries in Asia, Latin America and Sub-Saharan Africa perform weakly.

Examining and analysing the trends from data collection, nutritional monitoring and active surveillance can support governments and policymakers in implementing data-driven strategies to overcome food insecurity in women and children, as well as among minority groups. Although 90 countries (the majority of countries in the GFSI) have nutritional monitoring and surveillance in place, this number represents scant year-on-year progress, with just three countries (Madagascar, Nicaragua and Turkey) implementing new monitoring initiatives since we compiled the previous GFSI. The latest index reveals that a majority of the countries in the index have put in place a national nutrition plan or strategy, while 22 countries still lack one.

International organisations have driven progress in data collection and monitoring in recent years. The FAO and the US-based International Food Policy Research Institute (IFPRI) are developing gender-disaggregated food security data, for instance. The FAO has also begun collecting individual-level data for its Food Insecurity Experience Scale (FIES).[65,66] GFSI 2020 includes country-level FIES data, in an effort to track the relationship between individual drivers of food security in the index and wider health and food security outcome metrics. Based on FIES data, women have a 27% higher chance than men of experiencing severe food insecurity.[67] The FAO advises governments to devise inclusive and responsive policies through gender-sensitive reporting and monitoring frameworks in consultation with local women leaders.[68,69] Based on its Women's Empowerment in Agriculture Index (WEAI), the IFPRI is building new instruments to study women's empowerment within specific food security programmes (Project WEAI) and across agricultural value chains (Project-level WEAI for Market Inclusion).[70,71] Such efforts to build disaggregated food security datasets can inform inclusive policy decisions on food security that effectively cater to the needs of all vulnerable social groups.

64 Galetti V. "Zinc Deficiency and Stunting". In: Preedy V, Patel V(eds). Handbook of Famine, Starvation, and Nutrient Deprivation. 2018. Springer: Cham. Available at: https://link.springer.com/referenceworkentry/10.1007/978-3-319-40007-5_93-1

65 Walsh T. "How can data build a truer picture of the gender gap in food insecurity?" Devex. 2020. Available at: https://www.devex.com/news/how-can-data-build-a-truer-picture-of-the-gender-gap-in-food-insecurity-96488

66 FAO. "Voices of the hungry: FAQ". 2020. Available at: http://www.fao.org/in-action/voices-of-the-hungry/faq/en/

67 FAO, IFAD, UNICEF, WFP and WHO. "The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets". Available at: https://www.unicef.org/media/72676/file/SOFI-2020-full-report.pdf

68 FAO. "Gendered impacts of COVID-19 and equitable policy responses in agriculture, food security and nutrition". 2020. Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/CA9198EN.pdf

69 FAO. "Adding a gender lens into FAO's response to COVID-19 – programme guidance". 2020. Available at: http://www.fao.org/3/ca9299en/CA9299EN.pdf

70 IFPRI-WEAI. "Pro-WEAI". 2020. Available at: http://weai.ifpri.info/versions/pro-weai/

71 IFPRI-WEAI. "PRO-WEAI+MI". 2020. Available at: http://weai.ifpri.info/versions/weai4vc/

Nutrition-sensitive value chains aim to achieve food and nutritional security

Food and nutrition policies can often be disconnected, with the former focusing on supporting the economic viability of farmers and the latter on ensuring access to healthy food for populations. However, governments are finding ways to achieve both goals simultaneously through developing value chains in a way that is sensitive to the nutritional needs of populations, as well as by specifically shaping the development of value chains for nutritious commodities in ways that will make these foods affordable, accessible and economically viable.

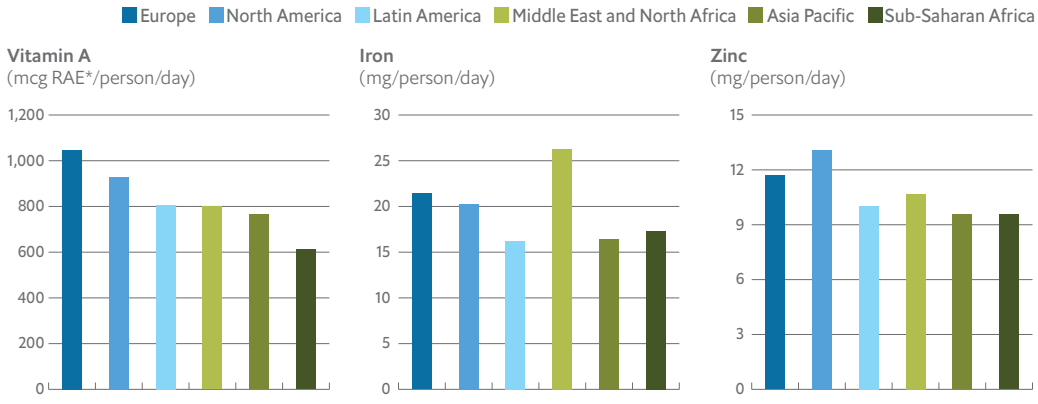
For instance, Smallholder Livelihood Development Project, an Indonesian initiative, identified food commodities that could address nutrition gaps for adolescent girls, including bananas, cassava, maize, spinach, sweet potatoes and fish, which are micronutrient-rich foods with potential for additional biofortification, and which also present a viable and scalable business opportunity for smallholders.[72]

Gender inequalities can also be tackled by innovations in business models and stakeholder partnerships. One leading example is Grameen Danone, which distributed a fortified yoghurt to address micronutrient deficiencies in poor areas of Bangladesh.[73] Over time, the initiative adapted to include delivery to middle- and high-income households as well, in order to achieve financial sustainability.

Figure 9

Dietary availability of micronutrients

Vitamin A, Iron and Zinc



* RAE stands for Retinol Activity Equivalent

Source : Global Food Security Index 2020.

72 International Fund for Agricultural Development. "Developing nutrition-sensitive value chains in Indonesia: Findings from IFAD research for development". 2018. Available at: https://www.ifad.org/documents/38714170/40197148/Indonesia_brochure.pdf/9ab34286-983d-4b3c-ba85-d6950a50ab68

73 International Fund for Agricultural Development. "Nutrition-sensitive value chains from a smallholder perspective". 2018. Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/30_Research_web.pdf

Engaging local government in nutritional strategy can also help. Kenya, for instance, provides guidance for nutrition programmes at the county level through its Nutrition Action Plan 2018-22.[74] Those grappling with persistent malnutrition are able to access nutrient-dense foods stockpiled by the Kenya Medical Supplies Authority.[75] In addition, programmes expanding nutritional counselling and cash transfers in drought-prone areas have been linked to improvements in dietary diversification.[76] Kenya has also expanded existing severe acute malnutrition services, as well as increasing coverage for vitamin A, iron and folic acid supplementation.

74 UNICEF. "Country Office Annual Report 2019: Kenya". 2019. Available at: https://www.unicef.org/about/annualreport/files/Kenya-2019-COAR(1).pdf

75 Ministry of Health of Kenya. "Kenya includes nutrition commodities in the essential medical list Nairobi". 2019. Available at: https://www.health.go.ke/kenya-includes-nutrition-commodities-in-the-essential-medical-list-moh-public-communications-2152-1-hour-ago-to-me-rachael-jayne-kenya-includes-nutrition-commodities-in-the-essential-medical/

76 Cachigi J. Evaluation of nutrition improvement through cash & health education (NICHE) program in Kenya. 2019. Available at: https://www.slideshare.net/TheTransferProject/evaluation-of-nutrition-improvements-through-cash-health-education-program-in-kenya

Chapter 3: Environmental and natural resources inequality

Building resilient food systems through effective risk management

Productivity and environmental sustainability are no longer distinct objectives of the global food system. Although climate risk has always been an important component of the GFSI, it has previously been included as an adjustment to the overall scores. This year, "Natural Resources and Resilience" became a category of the core index for the first time, highlighting the interdependence of natural resources and food systems and the need for solutions that can address them simultaneously. As a result of this methodological change, this edition of the GFSI includes updated data and scores for the entire (2012-20) index period.

Several nations face food security challenges due to environmental and climatic fragility or constraints to natural resources. Rising temperatures and extreme weather patterns continue to threaten food systems, and climate-risk preparedness varies across countries. Some governments are adapting quickly by prioritising environmental issues—for instance, by investing in early-warning systems that can protect from impending environmental threats and incentivising innovations that can reduce their dependence on imported food.

Rising temperatures, failed rains and extreme weather events need urgent attention

The Intergovernmental Panel on Climate Change (IPCC) forecasts a temperature rise of 2.5-10 degrees Fahrenheit over the next century, which would have a powerful negative effect on biodiversity and food production.[77] The countries at highest risk of temperature increases, according to the 2020 GFSI, include Singapore, Malaysia, Indonesia and the Philippines, along with several countries in Latin America (Ecuador, the Dominican Republic, Peru, Colombia and El Salvador).

Global warming has increased economic inequality between and within countries. The divergence between the groups of countries with the highest and lowest economic output was estimated to be 25% larger in 2019 than it would have been in the absence of climate change. Estimates also suggest that global warming decreased the wealth per person in the world's poorest countries by 17-30% between 1961 and 2010.[78]

Rising temperatures and global warming have a direct impact on the agricultural sector and food systems. In Latin America, irregular rainfall and above-average temperatures between June and July 2019 led to a second consecutive year of crop failure in the 'Dry Corridor' spanning Guatemala, Honduras, El Salvador and Nicaragua.[79] In East Africa and parts of Southwest Asia, the intersection of climate change and extreme weather has fuelled the worst desert locust upsurge in over 25 years; this, along with covid-19, has spurred an increase in the number of people who are severely food insecure.[80]

Warmer temperatures are also increasing the

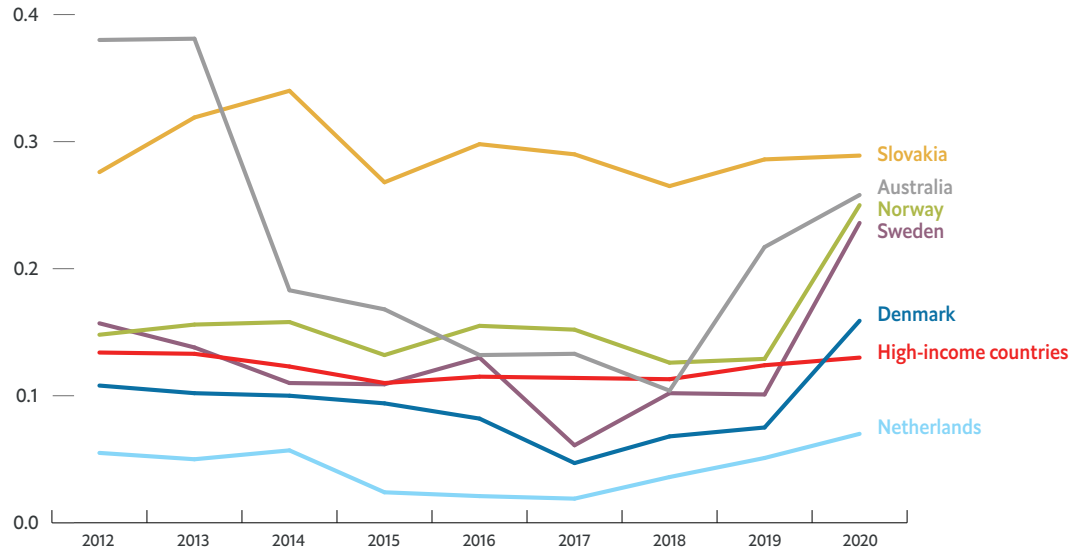
77 NASA. "The effects of climate change". 2020. Based on the Fourth Climate Assessment of the Intergovernmental Panel on Climate Change (IPCC). Available at: https://climate.nasa.gov/effects/

78 Diffenbaugh NS, Burke M. "Global warming has increased global economic inequality". Proceedings of the National Academy of Sciences. May 2019. 116;20;9808-9813.Available at: https://www.pnas.org/content/116/20/9808

79 Reliefweb. "Latin America & the Caribbean - Monthly Situation Snapshot - As of 01 November 2019". 2019. Available at: https://reliefweb.int/report/world/latin-america-caribbean-monthly-situation-snapshot-01-november-2019

80 FAO. "Greater Horn of Africa and Yemen Desert locust crisis appeal January–December 2020. Rapid response and sustained action". 2020. Available at: http://www.fao.org/3/ca9257en/CA9257EN.pdf

Figure 10
Volatility of agricultural production
Standard deviation in the growth rates of cereal and vegetable production in select high-income countries



Sources: FAO, Global Food Security Index 2020.

frequency and severity of forest fires; agricultural land accounted for approximately 14% of the area burned in bushfires in Australia, and heat and dense smoke from wildfires in the US have made working conditions in fields near impossible.[81,82] The latest GFSI finds that both Australia and the US are already impacted by high levels of land degradation, ranking 81st and 63rd respectively on this metric.

Other high-income countries have also suffered food production shocks in recent years owing to unpredictable climate change events. This year's GFSI finds that agricultural production has become more volatile in 49 countries than in the period covered by the 2019 index (Figure 10). Australia, Norway and Slovakia rank in the bottom ten in terms of production volatility (meaning that they have high levels of volatility). Denmark, Norway and Sweden, in particular, dropped significantly, caused by droughts in Norway and Denmark, and an extreme summer heatwave in Sweden.[83,84] In 2018, Norway saw its worst crop production levels in over 50 years, while Denmark's crop harvest fell by 40%. In Sweden, extreme summer weather in 2018 led to the country's worst crop harvest since the 1950s.[85] Botswana, Sri Lanka and Uzbekistan have also shown extremely volatile production compared with 2012 levels.

81 Kemp D. "Agricultural land comprises 14% of total area burned by Australian bushfires". Agri Investor. 2020. Available at: https://www.agriinvestor.com/agricultural-land-comprises-14-of-total-area-burned-by-australian-bushfires/

82 Sengupta S. "Heat, Smoke and Covid Are Battering the Workers Who Feed America". New York Times. 2020. Available at: https://www.nytimes.com/2020/08/25/climate/california-farm-workers-climate-change.html

83 Xinhua. "Drought causes Norway's worst crop production in over 50 years". 2018. Available at: http://www.xinhuanet.com/english/2018-07/31/c_137359922.htm

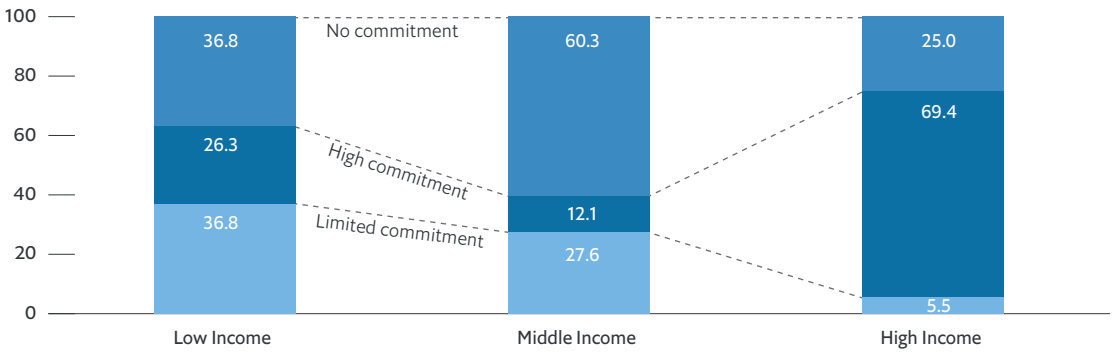
84 Reuters. "Danish crop harvest to fall 40 percent due to drought". 2018. Available at: https://in.reuters.com/article/agriculture-drought-denmark/danish-crop-harvest-to-fall-40-percent-due-to-drought-idUSL5N1V02OH

85 Bioenergy International. "Sweden's 2018 crop harvest worst since the late 1950's". 2018. Available at: https://bioenergyinternational.com/feedstock/swedens-2018-crop-harvest-worst-since-the-late-1950s

Figure 11

Commitment to developing early warning measures in agriculture, and investments in climate-smart agriculture practices

% of countries committed to early-warning measures / climate-smart agriculture



Source: Global Food Security Index 2020.

Climate-smart agriculture can help countries to prepare for the future

Governmental efforts to manage climate risks is a key tenet of the GFSI, given the interaction between climate change and the food system. Policy commitment to agricultural adaptation has been mixed, with 72 countries having a national climate change strategy that covers agricultural adaptation, and 34 lacking any such plan (or having an outdated plan), including countries at high risk of climate impacts, such as India, Yemen and Indonesia.

Scores are lower still in terms of political commitment to manage risks related to climate and natural resources—34 countries scored in the lowest band, and 14 countries scored zero, including exposed nations like Australia and Pakistan. In Asia, all countries except Japan, Kazakhstan, Myanmar, New Zealand and Uzbekistan have limited or no commitment to developing early-warning measures for agriculture or investment in climate-smart agriculture practices. In contrast, all countries in Europe except Belarus, Serbia and Ukraine show stronger commitments.

The majority of countries demonstrate only a limited commitment to addressing agriculture-related climate exposure and natural resource management under their Nationally Determined Contributions (NDCs), with 77 out of 113 countries scoring 0 on this indicator. Along with some European countries (such as Finland, Ireland, Netherlands and Ukraine), high- and upper-middle-income countries from Asia (Japan, Kazakhstan, Malaysia, Myanmar and South Korea, as well as New Zealand) perform strongly on this indicator. Adaptation and mitigation measures can reduce the impact of natural disasters, increase agricultural productivity and ensure that food systems are resilient.

Successful regional pilots in climate-smart agriculture offer global lessons

Pilot programmes and scale-up initiatives led by governments, producers and international organisations have pushed the expansion of climate-smart agriculture. The Consultative Group on International Agricultural Research (CGIAR), an organisation that brings together the work of several agricultural research facilities located across the world, continues to make substantial investments, with 12 leading projects in 2019, primarily in Sub-Saharan African and Latin America, covering low-emission agriculture, improved climate risk mapping and dietary innovations for reduced livestock emissions[86].

The World Bank also continues to support climate-smart agriculture projects with a combined commitment of more than a billion dollars. The largest commitment to date is the US$420m it has committed to the Maharashtra Project on Climate Resilient Agriculture, in India. More than 300,000 project beneficiaries (mainly smallholder and marginal farmers) have adopted climate-smart agriculture practices, and more than 56,000 ha of land have benefited from improved irrigation and drainage technologies.[87]

Over 2m farmers in 13 African countries are now growing drought-tolerant maize that has been developed by the Drought Tolerant Maize for Africa (DTMA) initiative, and distributed through national research programmes and private seed company initiatives. As a result, food security has been boosted by a 20-30% increase in yields and US$1bn of benefits to farmers and consumers.[88,89]

These climate-smart initiatives can be replicated and applied to different regions that share similar risks. For example, an ex-ante study of the DTMA initiative estimates that drought-tolerant maize could help more than 4m people worldwide to escape poverty while improving the livelihoods of many more.[90] The scaling up of such initiatives would be especially suitable in countries that already produce high amounts of maize, such as Kenya, Malawi and Nigeria.

86 The CGIAR Research Program on Climate Change, Agriculture and Food Security. "Making an impact on climate change adaptation and mitigation around the word. Recent CCAFS success stories." 2019. Available at: https://ccafs.exposure.co/making-an-impact-on-climate-change-adaptation-and-mitigation-around-the-world

87 World Bank. "Project Signing: Government of India and the World Bank Sign a New Project to Benefit Over 25 Million Small and Marginal Farmers in Maharashtra". 2018. Available at: https://www.worldbank.org/en/news/press-release/2018/04/06/government-india-world-bank-sign-new-project-benefit-over-25million-small-marginal-farmers-maharashtra

88 Climate Smart Agriculture-101. "Drought-tolerant maize for Africa (DTMA)". Available at: https://csa.guide/csa/drought-tolerant-maize-for-africa-dtma

89 The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). "Drought-tolerant maize boosting food security in 13 African countries". Available at: https://ccafs.cgiar.org/bigfacts/#theme=evidence-of-success&subtheme=crops&casestudy=cropsCs2

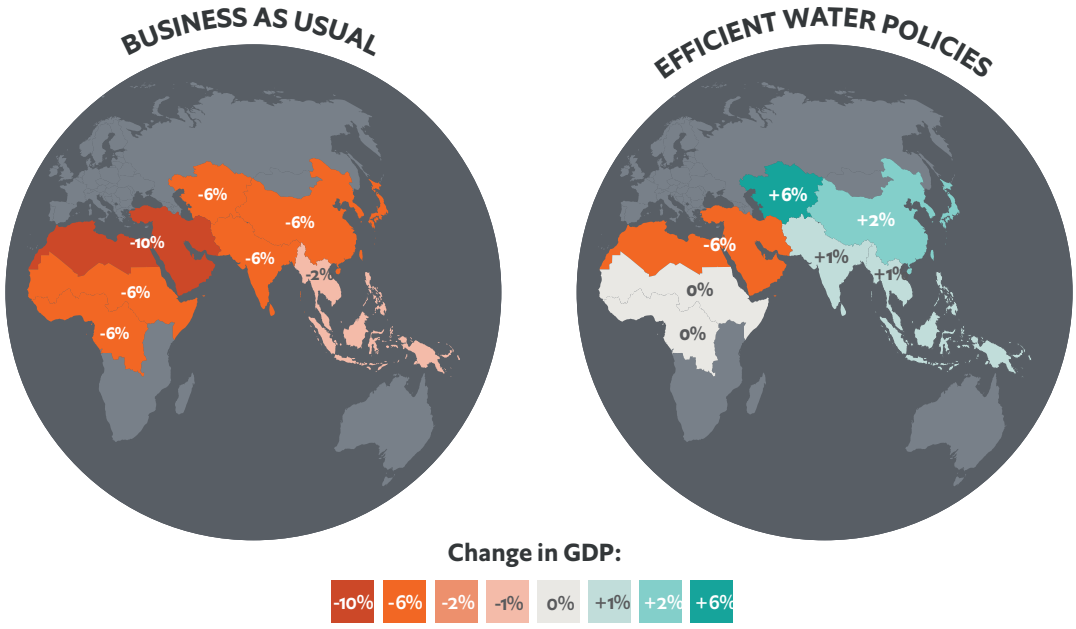
90 La Rovere RK, Kostandini G, Abdoulaye T, Dixon J, Mwangi W, Guo Z, Banziger M. "Potential impact of investments in drought tolerant maize in Africa (p. 38)". 2010. Addis Ababa: CIMMYT. Available at: https://cgspace.cgiar.org/handle/10568/88220

Public-sector commitment and private-sector innovation drive investment in water management systems

As the latest index shows, many countries are susceptible to flooding, causing crop loss and volatile food supplies. The GFSI highlights several low- and middle-income nations, such as those in the Sahel region in Africa (Niger, Chad, Burkina Faso and Nigeria) and some in Asia (China, India, Bangladesh, South Korea and Sri Lanka) that are at increasing risk of flooding, which adversely impacts livelihoods, agricultural production and food security. In June 2020 the longest-running flood in decades submerged over a quarter of Bangladesh, damaging over 125,000 ha of agricultural land and leaving 700,000 households in need of food and agricultural support. Poorer countries facing significant flood risks can examine solutions developed by other emerging economies and prepare for water-related disasters like floods by investing in water conservation and sustainable infrastructure.

China stands out for commitments to adaptation in the form of investment in water conservancy projects to prevent flooding. In July 2020 China announced plans to advance 150 new water conservancy projects worth US$184.4bn involving flood control, irrigation and water supply, ecological protection, and smart water conservancy.[91] In particular, China's US$1bn investment in a water management project on the Bangladesh-India border may eventually bring relief to Bangladeshi farmers besieged by

Figure 12
Effects of water allocation policies on GDP in 2050
Estimated change in 2050 GDP under two scenarios



Sources: Global Commission on Adaptation, World Bank, World Resources Institute.

91 China Daily. "China to advance water conservancy projects construction". 2020. Available at: https://www.chinadaily.com.cn/a/202007/13/WS5f0c1590a310834817259125.html

floods and droughts near the Teesta River.[92,93]

Clean water is essential to the food sector—and for human health, given that diarrhoea and illness caused by contaminated water is a major source of under-nutrition. The past year has seen a range of water interventions from local and low-tech initiatives to large infrastructure developments. Moreover, adoption of efficient water policies can tangibly impact the growth rates in countries (Figure 12). The FAO complimented progress made in areas such as water desalination, water harvesting and drip irrigation in the drought-prone Middle East and North Africa.[94] Following concerns about water security and sustainability, China's Ministry of Water Resources has signed memoranda of understanding with over 60 national water resource authorities and conducted over 100 fact-finding visits to countries including the Netherlands and Switzerland.[95] It is also providing training to nearly 2000 water resource specialists from 112 countries and providing assistance on water conservancy and related projects.

Israel is advancing its own water infrastructure with the recent completion of a 14km-long water tunnel transporting desalinated drinking water.[96] As part of its ongoing digital transformation efforts, the national water company is centralising its operations, adopting the use of machine learning and smart meters, and investing in cybersecurity. It has systems in place to minimise leakage and treat 90% of wastewater for agricultural use.

92 The Economist. "As Bangladesh's relations with India weaken, ties with China strengthen". 2020. Available at: https://www.economist.com/asia/2020/09/19/as-bangladeshs-relations-with-india-weaken-ties-with-china-strengthen

93 Parry AW. "Teesta River Dispute Between India and Bangladesh". INSAMER. 2020. Available at: https://insamer.com/en/teesta-river-dispute-between-india-and-bangladesh_2634.html

94 Reliefweb. "FAO chief calls for innovative approaches and investments to ensure enough water for everyone in the Near East and North Africa". 2019. Available at: https://reliefweb.int/report/world/fao-chief-calls-innovative-approaches-and-investments-ensure-enough-water-everyone-near

95 Moore S. "The Blue Belt and Road: China's Belt and Road and the World's Water Resources". Reconnecting Asia. 2019. Available at: https://reconnectingasia.csis.org/analysis/entries/blue-belt-and-road/

96 Rosenbaum A. "Using Israeli technology to live in a water-stressed world". Jerusalem Post. 2020. Available at: https://www.jpost.com/israel-news/using-israeli-technology-to-live-in-a-water-stressed-world-627227

R&D competitions and start-up accelerators are essential to encouraging innovation and enabling countries to adopt more efficient water management systems

Governments can pioneer the development of efficient water systems by incentivising private-sector participation through start-up accelerators and competitions, and supporting research. Water-related R&D continues to attract funding and institutional backing. In early 2020 Stellenbosch University in South Africa joined forces with Fraunhofer-Gesellschaft, a German research organisation, to establish the Fraunhofer Innovation Platform for the Water-Energy-Food Nexus to develop cross-sectoral solutions for water, energy and food security, including exploring the use of processing technologies and sensors to improve water recycling. Governments are initiating innovation funding streams. Ofwat, the UK's water regulator, has allocated £200m (US$272m) to a series of water innovation competitions in 2020-25.[97]

Start-ups are exploring new approaches to apply data and technology to water security. Imagine H20, a non-profit from the US, has now raised US$500m to support water-related innovations. Its portfolio includes companies in food-related areas, including groundwater modelling and predictive analytics, remote infrastructure monitoring, flood insurance, conversion of food waste to fertiliser, and the use of machine learning and remote sending to provide SMS updates for farmers on climate and weather forecasts.[98] Other promising technology trends currently include the use of telemetric systems and remote sensing to monitor and analyse groundwater, piloted in several countries in Africa and Southeast Asia, and the development of low-cost sensors and wireless communications systems to monitor water quality efficiently and affordably.[99,100]

97 WiredGov. "Ofwat drives forward plans on its innovation fund and competitions". 2020. Available at: https://www.wired-gov.net/wg/news.nsf/articles/Ofwat+drives+forward+plans+on+its+innovation+fund+and+competitions+19082020091500?open

98 Imagine H2O. "Our Mission". Available at: https://www.imagineh2o.org/mission

99 SIWI World Water Week. "Innovations in groundwater monitoring: Potential of telemetry and remote sensing". Available at: https://www.worldwaterweek.org/event/8562-innovations-in-groundwater-monitoring-potential-of-telemetry-and-remote-sensing

100 Demetillo AT, Japitana MV, Taboada EB. A system for monitoring water quality in a large aquatic area using wireless sensor network technology. Sustain Environ Res. 29;12. 2019. Available at: https://sustainenvironres.biomedcentral.com/articles/10.1186/s42834-019-0009-4

As food import vulnerabilities increase in resource-constrained countries, governments are embracing technological innovation

The 2020 GFSI finds that food import dependency, which puts countries at the mercy of fluctuations in trade and food prices, is a worsening problem in some nations—37 countries posted an increase in dependency on food imports over the measured period. Increased dependency on food imports poses a threat to food security owing to exchange-rate fluctuations and the risk of disruptions to food supply in export countries. Cereal staples comprised the majority of imported food items among the UN-designated Least Developed Countries in 2000 and 2017, underscoring the dependence of these countries on the global marketplace to meet the basic food needs of their populations.[101,102]

Some countries, particularly import-dependent, high-income countries in the Middle East and Asia are already reorienting their trade strategies and encouraging domestic innovation in an effort to reduce their dependence on food imports. Gulf Cooperation Council (GCC) countries, which import approximately 85% of their food, learned lessons from a 2008 crisis when export restrictions tightened global food supplies. Since then, GCC countries have built up their food reserves to last up to 12 months for wheat stocks and up to six months for produce, meat, fish, and dairy products. Their food processing industries can more reliably divert food if needed. They have also ensured that food import contracts and agricultural investments abroad are geographically diverse. The UAE is also taking steps to boost local production by supporting ventures in hydroponics, aquaponics and vertical farming. Singapore, which imports over 90% of its food, has also developed its resilience systems. In addition to diversifying food suppliers and growing food abroad, the city-state is looking to scale-up local production through vertical farms and investing in alternative proteins.

101 The least developed countries is a list of developing countries that, according to the UN, exhibit the lowest indicators of socioeconomic development, with the lowest Human Development Index ratings of all countries in the world.

102 FAO. "Food Outlook - Biannual report on global food markets". 2018. Available at: http://www.fao.org/3/CA0239EN/ca0239en.pdf

Policy prioritisation, R&D investment and trade facilitation can make nutritious food more accessible and affordable

In 2019 Singapore introduced the "30 by 30" plan, which aims to increase food self-sufficiency from 10% to 30% by 2030.[103] The pandemic resulted in further ramping up of local vegetable production as the country sponsored advanced agricultural technologies, including large indoor vertical farms.[104] In the face of covid-19, the country has developed supply-chain connectivity agreements with six other trading partners: Australia, Brunei, Canada, Chile, Myanmar and New Zealand.[105] Existing food production collaboration projects also allow some production to be exported back to Singapore; an example is a 2500 sq km agri-food zone in Jilin province, China, that has started exporting rice**.**

Gulf nations have also continued a long-term strategy of investing directly in food supply chains. Abu Dhabi Investment Office, a government agency, has provided investment to four agricultural technology companies to build facilities in the Emirate, including AeroFarms, a US-based group that plans to build a 90,000 sq ft indoor vertical farm and research facility. The UAE, meanwhile, is seeking to reduce its reliance on food imports with investments in crop-growing research projects and US$54m on aquaculture projects. The country is conducting research to test crop varieties that can survive in the harsh high local temperatures. The UAE has also collaborated with South Korea's Rural Development Administration in a first-of-its-kind rice cultivation research project.[106,107]

Governments are also demonstrating their awareness of the positive impacts of good trade policy on affordability of quality foods. Evidence from Central America shows that tariff removal has had a positive impact on the cost of nutrient-rich diets, making them more affordable. This has improved nutritional outcomes in a region that is characterised by the coexistence of undernutrition and obesity.[108] The region is nearing the end of a trade liberalisation process initiated in 2006 with the US and the Dominican Republic (the Dominican Republic-Central America Free-Trade Agreement, known as DR-CAFTA), with tariff protections due to expire in 2021.[109] The FAO has estimated that removing trade protections across the Central America region would reduce the cost of a nutrition-adequate diet by anywhere between US$0.12 and US$0.24 per day, with the highest gains in the poorest countries. Increasing the affordability of nutrient-rich diets is critical to ensuring food and nutrition security going forward.

103 Teng P, Montesclaros J, Hulme R, Powell A. "The Evolving Singapore Agrifood Ecosystem". NTS Insight. 2019. Available at: https://www.rsis.edu.sg/wp-content/uploads/2019/08/NTS-Insight-TengMontesclarosHulmePowell-Aug2019.pdf

104 Teng P. "Assuring food security in Singapore, a small island state facing COVID-19". Food Security. 2020. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7338144/

105 Italian Trade Agency. "COVID-19 pandemic highlights importance of strengthening Singapore's food securi". 2020. Available at: https://www.ice.it/it/news/notizie-dal-mondo/146023

106 Guan YL. Future of food security? UAE seeks to reduce import reliance with crop growing projects. Food Navigator-Asia. 2020. Available at: https://www.foodnavigator-asia.com/Article/2020/08/26/Future-of-food-security-UAE-seeks-to-reduce-import-reliance-with-crop-growing-projects

107 Guan YL. Reducing reliance on imports: UAE turns to aquaculture to boost food security. Food Navigator-Asia. 2020. Available at: https://www.foodnavigator-asia.com/Article/2020/07/15/Reducing-reliance-on-imports-UAE-turns-to-aquaculture-to-boost-food-security

108 FAO, IFAD, UNICEF, WFP and WHO. "The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets". 2020. Available at: http://www.fao.org/3/ca9692en/online/ca9692en.html

109 Ibid.

Conclusion: Reducing inequality to strengthen resilience

Progress on ensuring food security was stalling prior to the start of the covid-19 pandemic at the turn of 2020, in part reflecting a slowdown in poverty reduction. However, covid-19 has tested food systems and further aggravated existing social inequalities by disproportionately affecting the less fortunate in society, whether due to gender, race, income level or labour-market precarity.

Governments and multilaterals have shown strong commitment and high agility in responding to the pandemic. Policymakers have unleashed unprecedented levels of financial assistance, which has helped to ensure that income shortages do not translate to nutritional shocks—in some cases, these measures have included specific support for farmers and agricultural producers to enable harvesting and production to continue. School meal programmes have been re-designed despite shutdowns, including through efforts to connect agricultural producers to new procurement opportunities. The food e-commerce sector, led by tech companies large and small, has quickly stepped in to match supply and demand.

Long-standing challenges to food systems, notably environmental degradation and climate change, will only intensify in the years ahead, requiring all stakeholders to maintain and quicken progress towards adopting techniques, innovations and policies that will widen access to nutritious food within tightening ecological limits. Governments in high-income countries are already showing a high commitment to developing early-warning measures in agriculture and investments in climate-smart agriculture. Developing countries can create resilient growth by learning from best practices such as categorising agriculture-related climate exposure within nationally-determined climate contributions under the Paris accord.

While countries face varying levels of impact from climate change, some are prioritising and preparing better than others. Investments in sustainable infrastructure, agricultural R&D and private-sector innovation is helping countries like China, Israel and the UK to prioritise sustainable development. Gulf countries are investing directly in innovative ventures in food supply chains, and some—including Singapore and the UAE—are optimising production by experimenting with farm innovations like vertical farming and aquaculture.

As countries strive towards protecting their food systems from climate-related shocks, it will also be crucial that these food systems protect the most vulnerable. The covid-19 pandemic provides an opportunity to revisit the fundamentals of food systems to renew and reinvigorate the quest to achieve food security for all. Key goals for stakeholders in addressing structural inequalities should include providing sustainable financing for food safety nets, enriching nutritional data to better identify vulnerable groups, and removing barriers for disadvantaged groups like women to enable them to become a part of the dialogue on achieving food security for all.

Appendix I: GFSI 2020 results

2020 GFSI overall rankings table

Weighted total of all category scores (0-100 where 100 = most favourable)

Rank	Country	Score / 100
1	Finland	85.3
2	Ireland	83.8
3	Netherlands	79.9
4	Austria	79.4
5	Czech Republic	78.6
6	United Kingdom	78.5
7	Sweden	78.1
8	Israel	78.0
9	Japan	77.9
10	Switzerland	77.7
11	United States	77.5
12	Canada	77.2
=13	Germany	77.0
=13	New Zealand	77.0
=15	Denmark	76.6
=15	Italy	76.6
17	France	76.5
18	Norway	76.2
=19	Portugal	75.7
=19	Singapore	75.7
21	Belgium	75.2
22	Romania	74.2
23	Belarus	73.8
24	Russia	73.7
25	Poland	73.5
26	Spain	73.4
27	Greece	73.0
28	Costa Rica	72.3
29	South Korea	72.1
30	Uruguay	71.4
31	Australia	71.3
32	Kazakhstan	70.8
33	Kuwait	70.7
=34	Chile	70.2
=34	Oman	70.2
36	Hungary	70.1
37	Qatar	69.6
38	Saudi Arabia	69.5
39	China	69.3
40	Slovakia	69.2
41	Panama	68.9
42	United Arab Emirates	68.3
43	Malaysia	67.9
44	Bulgaria	67.4
45	Mexico	66.2
46	Peru	65.7
47	Turkey	65.3
48	Dominican Republic	65.2
49	Bahrain	64.6
50	Brazil	64.1
51	Thailand	64.0
52	Serbia	63.2
53	Colombia	63.1
54	Ukraine	63.0
55	Argentina	62.7
56	Azerbaijan	62.3
57	Morocco	62.0
58	Algeria	61.8
59	Tunisia	61.4
60	Egypt	61.1
61	Paraguay	60.5
62	Jordan	60.4
63	Vietnam	60.3
64	Bolivia	60.0
65	Indonesia	59.5
66	El Salvador	59.0
67	Honduras	58.2
68	Ecuador	57.9
69	South Africa	57.8
70	Myanmar	56.6
=71	Guatemala	56.2
=71	India	56.2
73	Philippines	55.7
74	Botswana	55.5
75	Sri Lanka	54.8
76	Nicaragua	54.4
=77	Ghana	53.0
=77	Nepal	53.0
79	Mali	52.7
80	Pakistan	52.3
81	Cambodia	51.5
82	Côte d'Ivoire	51.0
83	Uzbekistan	50.9
84	Bangladesh	50.0
85	Tajikistan	49.4
86	Kenya	49.0
87	Niger	47.6
88	Burkina Faso	47.4
89	Tanzania	47.1
=90	Laos	46.4
=90	Senegal	46.4
92	Benin	46.2
93	Togo	44.9
94	Cameroon	44.7
95	Uganda	42.9
96	Venezuela	42.8
97	Angola	42.1
98	Congo (Dem. Rep.)	40.7
99	Mozambique	40.6
100	Nigeria	40.1
101	Syria	40.0
102	Guinea	39.5
103	Chad	39.4
104	Rwanda	38.8
105	Haiti	38.5
106	Madagascar	37.5
107	Burundi	37.1
=108	Ethiopia	37.0
=108	Sierra Leone	37.0
110	Malawi	36.7
111	Zambia	36.6
112	Sudan	36.0
113	Yemen	35.7

Score changes

(Net change in overall score, 2020 versus 2019)

Weighted total of all category scores (0-100, where 100 = most favourable) Score improved Score declined

Rank	Country	Score change
105	Haiti	+4.7
32	Kazakhstan	+2.7
54	Ukraine	+2.7
22	Romania	+2.6
80	Pakistan	+2.6
61	Paraguay	+2.3
99	Mozambique	+1.9
=77	Nepal	+1.8
44	Bulgaria	+1.7
24	Russia	+1.6
97	Angola	+1.6
33	Kuwait	+1.5
89	Tanzania	+1.5
107	Burundi	+1.3
74	Botswana	+1.2
=34	Oman	+1.1
=71	India	+1.1
51	Thailand	+1.1
49	Bahrain	+1.1
30	Uruguay	+0.9
76	Nicaragua	+0.9
85	Tajikistan	+0.9
83	Uzbekistan	+0.9
4	Austria	+0.8
79	Mali	+0.8
48	Dominican Republic	+0.8
12	Canada	+0.6
110	Malawi	+0.6
57	Morocco	+0.6
59	Tunisia	+0.6
23	Belarus	+0.5
86	Kenya	+0.5
46	Peru	+0.4
3	Netherlands	+0.3
94	Cameroon	+0.3
98	Congo (Dem. Rep.)	+0.3
70	Myanmar	+0.3
104	Rwanda	+0.3
1	Finland	+0.2
43	Malaysia	+0.2
52	Serbia	+0.2
40	Slovakia	+0.2
=15	Italy	+0.2
10	Switzerland	+0.1
92	Benin	+0.1
103	Chad	+0.1
82	Côte d'Ivoire	+0.1
5	Czech Republic	+0.1
36	Hungary	+0.1
8	Israel	+0.1
28	Costa Rica	0
6	United Kingdom	-0.1
=108	Ethiopia	-0.1
39	China	-0.1
26	Spain	-0.2
17	France	-0.2
11	United States	-0.2
=71	Guatemala	-0.3
2	Ireland	-0.3
87	Niger	-0.3
113	Yemen	-0.3
=77	Ghana	-0.4
67	Honduras	-0.5
9	Japan	-0.5
106	Madagascar	-0.5
95	Uganda	-0.5
96	Venezuela	-0.5
63	Vietnam	-0.5
64	Bolivia	-0.6
112	Sudan	-0.6
25	Poland	-0.7
38	Saudi Arabia	-0.7
=19	Singapore	-0.7
29	South Korea	-0.7
47	Turkey	-0.7
=13	New Zealand	-0.8
=15	Denmark	-0.8
41	Panama	-0.9
81	Cambodia	-0.9
62	Jordan	-0.9
58	Algeria	-1.0
56	Azerbaijan	-1.0
=13	Germany	-1.1
=19	Portugal	-1.1
=90	Laos	-1.1
75	Sri Lanka	-1.2
88	Burkina Faso	-1.3
65	Indonesia	-1.4
69	South Africa	-1.4
21	Belgium	-1.6
84	Bangladesh	-1.6
66	El Salvador	-1.6
93	Togo	-1.6
45	Mexico	-1.7
=90	Senegal	-1.7
31	Australia	-1.8
27	Greece	-1.8
73	Philippines	-1.9
42	United Arab Emirates	-1.9
68	Ecuador	-2.0
37	Qatar	-2.1
55	Argentina	-2.3
100	Nigeria	-2.4
=108	Sierra Leone	-2.4
7	Sweden	-2.4
50	Brazil	-2.5
=34	Chile	-2.8
102	Guinea	-3.1
53	Colombia	-4.2
60	Egypt	-4.3
18	Norway	-4.4

Appendix II: Methodology

The Global Food Security Index (GFSI) considers the issues of food affordability, availability, quality and safety, and natural resources and resilience across a set of 113 countries. The index is a dynamic quantitative and qualitative benchmarking model constructed from 59 unique indicators that measure the drivers of food security across both developing and developed countries.

This edition of the GFSI incorporates the "Natural Resources and Resilience" category into the main index. This category assesses a country's exposure to the impacts of a changing climate, alongside its susceptibility to natural resource risks and how the country is adapting to these risks, all of which impact the incidence of food insecurity in a country. The category was first introduced into the GFSI in 2017 as an adjustment factor; its increasing importance has led to it becoming a category in its own right for the first time this year.

Upgrading the position in this index of this category—comprising exposure to climate shocks, water and land quality issues, population pressures, and government commitments to addressing the impacts of climate change on agriculture—has strengthened the GFSI. The new methodology assesses the natural resource perspective as a critical and central part of the conversation on food security, rather than as one that is separate but related. The inclusion of this fourth category into the main index addresses the perception that these are distinct issues and hopes to connect the dialogue on climate change with one on food security going forward.

The "Natural Resources and Resilience" category showcases how different countries are adapting and building resilience to climate and resource-related risks. Policymakers need to acknowledge the impact of climate-related factors on food systems and food security, and take immediate action. Incorporating the category also helps to identify potential opportunities for innovation, research and development, and capacity building. Governments must implement policies to enhance the sustainable management of food systems to achieve food security now, as early action and climate-smart practices need to be established to educate, train and build capacity in this sector.

For the 2020 GFSI, the EIU team reviewed the other three categories—"Affordability", "Availability", and "Quality and Safety"—to identify any need to add new sub-indicators or update the existing ones. The new sub-indicators that were added were done so based on research and recommendation from experts. New sub-indicators include inequality-adjusted income, gender inequality and armed conflict.

Other changes in the 2020 framework include updating indicators to rely on more up-to-date data sources and creating more challenging standards for existing qualitative metrics.

The categories and indicators included in the 2020 index are:

1)	AFFORDABILITY
1.1)	**Change in average food costs**
1.2)	**Proportion of population under global poverty line**
1.3)	**Inequality-adjusted income index**
1.4)	**Agricultural import tariffs**
1.5)	**Food safety-net programmes**
1.5.1)	Presence of food safety-net programmes
1.5.2)	Funding for food safety-net programmes
1.5.3)	Coverage of food safety-net programmes
1.5.4)	Operation of food safety-net programmes
1.6)	**Market access and agricultural financial services**
1.6.1)	Access to finance and financial products for farmers
1.6.2)	Access to diversified financial products
1.6.3)	Access to market data and mobile banking

2)	AVAILABILITY
2.1)	**Sufficiency of supply**
2.1.1)	Food supply adequacy
2.1.2)	Dependency on chronic food aid
2.2)	**Agricultural research and development**
2.2.1)	Public expenditure on agricultural research and development
2.2.2)	Access to agricultural technology, education and resources
2.3)	**Agricultural infrastructure**
2.3.1)	Crop storage facilities
2.3.2)	Road infrastructure
2.3.3)	Air, port and rail infrastructure
2.3.4)	Irrigation infrastructure
2.4)	**Volatility of agricultural production**
2.5)	**Political and social barriers to access**
2.5.1)	Armed conflict
2.5.2)	Political stability risk
2.5.3)	Corruption
2.5.4)	Gender inequality
2.6)	**Food loss**
2.7)	**Food security and access policy commitments**
2.7.1)	Food security strategy
2.7.2)	Food security agency

3)	QUALITY AND SAFETY
3.1)	**Dietary diversity**
3.2)	**Nutritional standards**
3.2.1)	National dietary guidelines
3.2.2)	National nutrition plan or strategy
3.2.3)	Nutrition labelling
3.2.4)	Nutrition monitoring and surveillance
3.3)	**Micronutrient availability**
3.3.1)	Dietary availability of vitamin A
3.3.2)	Dietary availability of iron
3.3.3)	Dietary availability of zinc
3.4)	**Protein quality**
3.5)	**Food safety**
3.5.1)	Food safety mechanisms
3.5.2)	Access to drinking water
3.5.3)	Ability to store food safely

4)	NATURAL RESOURCES & RESILIENCE
4.1)	**Exposure**
4.1.1)	Temperature rise
4.1.2)	Drought
4.1.3)	Flooding
4.1.4)	Storm severity (annual average loss)
4.1.5)	Sea level rise
4.2)	**Water**
4.2.1)	Agricultural water risk—quantity
4.2.2)	Agricultural water risk—quality
4.3)	**Land**
4.3.1)	Land degradation
4.3.2)	Grassland
4.3.3)	Forest change
4.4)	**Oceans, rivers and lakes**
4.4.1)	Eutrophication
4.4.2)	Marine biodiversity
4.5)	**Sensitivity**
4.5.1)	Food import dependency
4.5.2)	Dependence on natural capital
4.6)	**Political commitment to adaptation**
4.6.1)	Early-warning measures/climate-smart agriculture
4.6.2)	Commitment to managing exposure
4.6.3)	National agricultural adaptation policy
4.6.4)	Disaster risk management
4.7)	**Demographic stress**
4.7.1)	Projected population growth
4.7.2)	Urban absorption capacity

Data for the quantitative indicators are drawn from national and international statistical sources. Where there were missing values in quantitative or survey data, the EIU has used estimates. Estimated figures have been noted in the model workbook. Of the qualitative indicators, some have been created by the EIU, based on information from development banks and government websites, while others have been drawn from a range of surveys and data sources and adjusted by the EIU.

The main sources used in the GFSI are The Economist Intelligence Unit, the World Bank Group, the UN Food and Agriculture Organisation (FAO), the World Health Organisation (WHO), the World Trade Organisation (WTO), the OECD, Notre Dame Global Adaptation Initiative (ND-GAIN), the World Resources Institute (WRI), Yale Environmental Performance Index (EPI), the US Department of Agriculture (USDA), and national agriculture and health ministries.

Country selection

The 113 countries in the index were selected by the EIU based on regional diversity, economic importance, population size (countries with larger populations were chosen so that a greater share of the global population is represented) and the goal of including regions around the globe. The countries included in the 2019 index are:

Asia & Pacific
Australia
Azerbaijan
Bangladesh
Cambodia
China
India
Indonesia
Japan
Kazakhstan
Laos
Malaysia
Myanmar
Nepal
New Zealand
Pakistan
Philippines
Singapore
South Korea
Sri Lanka
Tajikistan
Thailand
Uzbekistan
Vietnam

Latin America
Haiti
Argentina
Bolivia
Brazil
Chile
Colombia
Costa Rica
Dominican Republic
Ecuador
El Salvador
Guatemala
Honduras
Mexico
Nicaragua
Panama
Paraguay
Peru
Uruguay
Venezuela

Europe
Ukraine
Austria
Belarus
Belgium
Bulgaria
Czech Republic
Denmark
Finland
France
Germany
Greece
Hungary
Ireland
Italy
Netherlands
Norway
Poland
Portugal
Romania
Russia
Serbia
Slovakia
Spain
Sweden
Switzerland
United Kingdom

Middle East & North Africa
Kuwait
Algeria
Bahrain
Egypt
Israel
Jordan
Morocco
Oman
Qatar
Saudi Arabia
Syria
Tunisia
Turkey
United Arab Emirates
Yemen

North America
Canada
United States

Sub-Saharan Africa
Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Chad
Congo (Dem. Rep.)
Côte d'Ivoire
Ethiopia
Ghana
Guinea
Kenya
Madagascar
Malawi
Mali
Mozambique
Niger
Nigeria
Rwanda
Senegal
Sierra Leone
South Africa
Sudan
Tanzania
Togo
Uganda
Zambia

Weightings

The weighting assigned to each category and indicator can be changed by users to reflect different assumptions about their relative importance. Two sets of weightings are provided in the index. One possible option, known as neutral weights, assumes that all indicators are equally important and distributes weightings evenly. The second available option, known as peer panel recommendation, averages the weightings suggested by five members of the 2012 expert panel. The expert weightings are the default weightings in the model. The model workbook also enables users to create customised weightings to allow them to test their own assumptions about the relative importance of each indicator.

Data modelling

Indicator scores are normalised and then aggregated across categories to enable a comparison of broader concepts across countries. Normalisation rebases the raw indicator data to a common unit so that it can be aggregated. The indicators for which a higher value indicates a more favourable environment for food security—inequality-adjusted income or food supply adequacy—have been normalised on the basis of:

$$x = \frac{(x - \text{Lower threshold}(x))}{(\text{Upper threshold}(x) - \text{Lower threshold}(x))}$$

where Lower threshold (x) and Upper threshold (x) are, respectively, specified for all series.

For the indicators for which a high value indicates an unfavourable environment for food security—such as volatility of agricultural production or political stability risk—the normalisation function takes the form of:

$$x = \frac{(x - \text{Upper threshold}(x))}{(\text{Upper threshold}(x) - \text{Lower threshold}(x))}$$

where Lower threshold(x) and Upper threshold(x) are, respectively, specified for all series.

The normalisation method, by which the underlying data for all series are converted into comparable scores of 0-100, has been updated. In the current 2020 edition, upper and lower threshold values are specified for all series (the data values which correspond to a score of 100 and zero respectively). This has been done to ensure that data outliers do not skew the scores. The same upper and lower thresholds are applied across all years 2012-20 for each series. In previous editions, normalisation thresholds for some series were calculated based on the minimum and maximum data values appearing in the dataset in each given year. Applying the same normalisation thresholds across all years means that scores can be compared directly across years; this makes for more intuitive time-series analysis.

Sources and definitions

The 2020 edition of the index introduces new data sources and datasets. The primary goal of the framework revision was to ensure that the GFSI is designed to be a powerful and forward-looking tool that highlights the major challenges for food security worldwide. Our review process included conversations with food security experts, desk research and data reviews by the EIU team, and conversations with users of the GFSI.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
1) Affordability				
1.1	Change in average food costs	FAO	A measure of the change in average food costs, as captured through the Food CPI which tracks changes in the price of the average basket of food goods since 2010.	Sharp increases in the cost of the average basket of food goods can indicate a decline in affordability.
1.2	Proportion of population under global poverty line	World Bank, World Development Indicators	A measure of the prevalence of poverty, calculated as the percentage of the population living on less than US$3.20/ day at 2011 purchasing power parity (PPP) exchange rates.	Poverty can lead to difficulty in being able to purchase food or inputs to produce food.
1.3	Inequality-adjusted income index	United Nations Development Programme (UNDP)	A measure of individual income (GNI per capita at 2011 PPP) adjusted for levels of inequality.	Average income levels can determine the affordability of food.
1.4	Agricultural import tariffs	World Trade Organisation (WTO)	A measure of the average most-favoured nation (MFN) tariff applied on all agricultural imports.	Agricultural tariffs can increase the cost of food imports, and therefore food costs for consumers.
1.5	Food safety net programmes	EIU calculation	A composite indicator assessing the presence and nature of food safety-net programmes. Subindicators include: • presence of food safety-net programmes; • funding for food safety-net programmes; • coverage of food safety net programmes; and • operation of food safety-net programmes.	
1.5.1	Presence of food safety-net programmes	Qualitative scoring by EIU analysts	An assessment of whether food safety-net programmes are present in the country.	Food safety-net programmes help to provide consistent food access for food insecure populations.
1.5.2	Funding for food safety-net programmes	Qualitative scoring by EIU analysts	An assessment of whether food safety-net programmes have funding.	Food safety net programmes with dedicated funding are better able to serve their target populations.
1.5.3	Coverage of food safety net programmes	Qualitative scoring by EIU analysts	An assessment of whether food safety-net programmes have national coverage and provide a range of services.	A broad range of services with nationwide coverage ensures coverage of all food insecure people in the country.
1.5.4	Operation of food safety-net programmes	Qualitative scoring by EIU analysts	An assessment of whether food safety-net programmes are operated by the national government (versus NGOs/ multilaterals).	Food safety-net programmes operated by the national government are more sustainable.
1.6	Market access and agricultural financial services	EIU calculation	A composite indicator measuring the market access and agricultural financial services. Subindicators include: • access to finance and financial products for farmers; • access to diversified financial products; and • access to market data and mobile banking.	
1.6.1	Access to finance and financial products for farmers	Qualitative scoring by EIU analysts; FAO	An assessment of access to affordable financial services for farmers.	Access to savings and credit improves farmer productivity and the ability of farmers to provide for their own families.
1.6.2	Access to diversified financial products	Qualitative scoring by EIU analysts	An assessment of the availability of diversified financial services that go beyond savings and credit for farmers.	Diversified financial tools such as weather-based/ parametric crop insurance, price hedging instruments, etc can enable farmers to survive economic and climate crises and operate their businesses.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
1.6.3	Access to market data and mobile banking	ITU	A measure of mobile subscribers per 100 inhabitants.	Mobile phone technology is critical for farmers to access up-to-date market information and agricultural extension services. Furthermore, farmers and food-insecure populations benefit from access to inclusive financial services, such as through mobile banking.
2) Availability				
2.1	Sufficiency of supply	EIU calculation	A composite indicator that measures the availability of food. It comprises the following subindicators: • food supply adequacy; and • dependency on chronic food aid.	
2.1.1	Food supply adequacy	FAO	A measure of the adequacy of food available for human consumption as a percentage of the average dietary energy requirement.	A sufficient supply of available food is essential for ensuring food security.
2.1.2	Dependency on chronic food aid	OECD	A measure of whether a country is a recipient of chronic food aid by assessing average emergency food aid per capita received over the past 5 years.	Consistent, high levels of food aid indicates that the available food supply is insufficient to meet the population needs.
2.2	Agricultural research and development	EIU calculation	A composite indicator that measures the agricultural research and development. It comprises the following subindicators: • public expenditure on agricultural research and development; and • access to agricultural technology, education and resources.	
2.2.1	Public expenditure on agricultural research and development	UN	A measure of government spending on agricultural R&D, as captured through the Agricultural Orientation Index, a proxy indicator assessing public investment in agriculture.	This indicator measures progress toward the Sustainable Development Goals Target 2.a on public investment in agriculture. This is a proxy indicator for investment in agricultural research and development.
2.2.2	Access to agricultural technology, education and resources	USDA	A measure of access to agricultural technology, education and resources, the total factor productivity (TFP) of agriculture, which assesses the productivity of agricultural inputs (land, labour, investment) as captured by annual growth in agricultural output minus annual growth in agricultural inputs.	Crop yields could be a valuable proxy for access to and adoption of technologies and best practices for agricultural management. The index assesses vegetable yields vs staple crop yields, as this shows an investment in national-level food security and production, rather than export, staple crops (this also factors in micronutrient availability vs available calories).
2.3	Agricultural infrastructure	EIU calculation	A composite indicator that measures ability to store crops and transport them to market. Subindicators include: • crop storage facilities; • road infrastructure; • air, port and rail infrastructure; and • irrigation infrastructure.	
2.3.1	Crop storage facilities	Qualitative scoring by EIU analysts	An assessment of whether there is evidence that the government has made investments through national funds or multilateral/donor funding to improve crop storage within the past five years.	Investments to improve or expand crop storage facilities are critical for ensuring there is a sufficient food supply.
2.3.2	Road infrastructure	EIU Risk Briefing	An assessment of the quality of road infrastructure, measured on a 0-4 scale, where 4 = best.	Regardless of country's geography and infrastructure, road infrastructure plays a crucial role in food transport.
2.3.3	Air, port and rail infrastructure	EIU Risk Briefing	An assessment of the quality of air, port and rail infrastructure, measured on a 0-4 scale, where 4 = best.	Depending on the country's geography and infrastructure, port, air and rail infrastructure play a crucial role in food transport.
2.3.4	Irrigation infrastructure	FAO	A measure of the percentage of cultivated agricultural area which is equipped for irrigation.	Irrigation infrastructure can support the ability of farmers to provide a consistent water supply for crops.
2.4	Volatility of agricultural production	FAO	A measure of the fluctuations in agricultural production, as captured by the standard deviation in the growth rates of cereal and vegetable production over the most recent 5-year period for which data are available.	Fluctuations in agricultural productivity can create difficulty in predicting and planning for a consistent food supply.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
2.5	Political and social barriers to access	EIU calculation	A composite indicator that measures political and social barriers to access.Subindicators include: • armed conflict; • political stability risk; • corruption; and • gender inequality.	
2.5.1	Armed conflict	EIU Risk Briefing	An assessment of the risk of armed conflict.	Armed conflict is a critical driver of food insecurity since it disrupts food production, access to markets and livelihoods.
2.5.2	Political stability risk	EIU Risk Briefing	An assessment of general political instability.	Political instability has the potential to disrupt access to food, for example through transport blockages or reduced food aid commitments.
2.5.3	Corruption	EIU Risk Briefing	An assessment of the risk and pervasiveness of corruption in a country.	Corruption can impact food availability through distortions and inefficiencies in the use of natural resources, as well as bottleneck inefficiencies in food distribution.
2.5.4	Gender inequality	UNDP	A measure of gender inequality inclusive of health, education, political capital and economic power.	As found by the FAO, women are disproportionately affected by hunger and malnutrition compared to men. Improved access to educational and economic opportunities can improve food security outcomes for women and families.
2.6	Food loss	FAO	A measure of post-harvest and pre-consumer food loss as a ratio of the domestic supply (production, net imports and stock changes) of crops, livestock and fish commodities (in tonnes).	Higher levels of food loss reduce the overall food availability.
2.7	Food security and access policy commitments	EIU calculation	A composite indicator that measures food security and access policy commitments. Subindicators include: • food security strategy; and • food security agency.	
2.7.1	Food security strategy	Qualitative scoring by EIU analysts	An assessment of whether there is a food security strategy in the country.	A national food security strategy assesses if the government has made food security a focus area and priority.
2.7.2	Food security agency	Qualitative scoring by EIU analysts	An assessment of whether the government is responsible and can be held accountable for food security.	A dedicated agency/department/ministry assesses whether the government has invested in, can be held accountable for, and is taking a coordinated approach to achieving food security.

3) Quality & Safety

3.1	Dietary diversity	FAO	A measure of the share of non-starchy foods (all foods other than cereals, roots and tubers) in total dietary energy consumption.	A larger share of non-starchy foods signifies greater diversity of food groups in the diet.
3.2	Nutritional standards	EIU calculation	A composite indicator that measures government commitment to increasing nutritional standards. It comprises the following binary subindicators: • national dietary guidelines; • national nutrition plan or strategy; • nutrition labelling; and • nutrition monitoring and surveillance.	
3.2.1	National dietary guidelines	EIU scoring	An assessment of whether the government has published guidelines and has conducted educational campaign within the past 1-2 years to disseminate messages on a balanced and nutritious diet.	Dietary guidelines help to share messaging on balanced and nutritious diets.
3.2.2	National nutrition plan or strategy	Qualitative scoring by EIU analysts based on WHO, FAO and national health ministry documents	An assessment of whether the government has a current, published national strategy to improve nutrition for both children and adults.	Children and adults have different nutritional needs.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
3.2.3	Nutrition labeling	Qualitative scoring by EIU analysts based on WHO, FAO and national health ministry documents	An assessment of whether the government requires packaged foods to include nutrition labelling information (nutrient declarations) in accordance with Codex recommendations (calories, protein, carbohydrates, fats, sodium, sugar).	In combination with education policies, labelling of packaged goods help consumers to better understand the caloric and nutritional value of purchased foods.
3.2.4	Nutrition monitoring and surveillance	Qualitative scoring by EIU analysts based on WHO, FAO and national health ministry documents	An assessment of whether the government monitors the nutritional status of the general population. Examples of monitoring and surveillance include the collection of data on undernourishment, nutrition-related deficiencies, etc.	Monitoring the nutritional status enables the government to identify current nutritional deficiencies and deploy resources where needed.
3.3	Micronutrient availability	EIU calculation	A composite indicator that measures the availability of micronutrients in the food supply. Subindicators include: • dietary availability of vitamin A; • dietary availability of iron; and • dietary availability of zinc.	
3.3.1	Dietary availability of vitamin A	Global Nutrient Database	A measure of the availability of Vitamin A, expressed in micrograms of retinol activity equivalent (RAE)/capita/day on a 0-2 scale.	Vitamin A is a critical micronutrient for health; deficiencies can cause blindness, among other health issues.
3.3.2	Dietary availability of iron	Global Nutrient Database	A measure of the availability of iron, expressed in mg/ capita/ day.	Iron is a critical micronutrient for health; deficiencies can cause anaemia, among other health issues.
3.3.3	Dietary availability of zinc	Global Nutrient Database	A measure of the availability of zinc, expressed in mg/ capita/day	Zinc is a critical micronutrient for health; deficiencies can compromise immune function and lead to infections.
3.4	Protein quality	EIU calculation based on data from FAO, WHO and US Department of Agriculture (USDA) Nutrient Database	A measure of the amount of high-quality protein in the diet using the methodology of the Protein Digestibility Corrected Amino Acid Score (PDCAAS). The PDCAAS methodology assesses the presence of nine essential amino acids in the average national diet. The inputs for this calculation include: the amino acid profile, protein digestibility value and the average amount (in grams) consumed of each food item that contributes a minimum of 2% to total protein consumption.	Protein supply alone is an insufficient assessment of nutrition; there are nine essential amino acids which humans cannot synthesize and must consume through dietary sources.
3.5	Food safety	EIU calculation	A composite indicator that measures the enabling environment for food safety. The subindicators are: • food safety mechanisms; • access to drinking water; and • ability to store food safely.	
3.5.1	Food safety mechanisms	WHO, Country-reported data	A measure of the efficacy of food safety mechanisms, as captured by a WHO-assigned score based on a 20+-question country self-assessment on food safety, including national standards, legislation, guidelines, laboratory capacity assessments and food recall and tracing plans. Scores are provided on a 0-100 scale.	A well-functioning and responsive food safety system helps to ensure safety of the food supply.
3.5.2	Access to drinking water	World Bank	A measure of the percentage of people using safely managed drinking water services.	A clean and consistent water supply is essential for food safety, for everything from washing produce to maintaining appropriate hygiene for food workers.
3.5.3	Ability to store food safely	UN	A measure of food storage and access to refrigeration, as captured through the proportion of the population with access to electricity, a proxy indicator.	Food-borne illnesses are caused by a range of factors including appropriate food storage.

4) Natural Resources & Resilience

4.1	Exposure	EIU calculation	A composite indicator that measures exposure to the impacts of climate change. Subindicators include: • temperature rise; • drought; • flooding; • storm severity (AAL); and • sea level rise.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
4.1.1	Temperature rise	Notre Dame Global Adaptation Initiative (ND-GAIN)	A measure of projected temperature rise. The projected change is the absolute change of the Warm Spell Duration Index from the baseline year (1960-90) to the future projection (2040-70), using an intermediate emissions scenario (RCP4.5 see IPCC, 2014).	Temperature rise affects agricultural production, both in terms of types of crops able to be grown in the area and the quantity produced.
4.1.2	Drought	World Resources Institute (WRI) Aqueduct	A measure of projected susceptibility of drought.	Susceptibility to drought can lead to unpredictable crop loss and declines in food supply in certain years.
4.1.3	Flooding	Notre Dame Global Adaptation Initiative (ND-GAIN)	A measure of extreme precipitation under climate change, a risk factor for flood hazard. The projected change is the percentage change of the flood hazard from the baseline projection (1960-90) to the future projection (2040-70), using an intermediate emissions scenario (RCP4.5 see IPCC, 2014). The flood hazard is measured by the monthly maximum precipitation in 5 consecutive days.	Susceptibility to flooding can lead to unpredictable crop loss and declines in food supply in certain years.
4.1.4	Storm severity (annual average loss)	Global Assessment Report on Disaster Risk Reduction	A measure of historical susceptibility to damage from storms (aside from flooding). Measured as annual average loss (AAL) from earthquakes, wind, storm surge and tsunamis as a percentage of the multi-hazard loss. Linear transformation of data values to a fixed range of 0-100. The country with the lowest data value scores 100 and the country with the highest data value scores 0.	Susceptibility to severe storms can lead to unpredictable crop loss and declines in food supply in certain years.
4.1.5	Sea level rise	Notre Dame Global Adaptation Initiative (ND-GAIN)	A measure of projected sea level rise. For landlocked countries, an estimate is provided based on the country's major coastal trading partners.	Sea level rise can lead to increased unpredictable crop loss and soil salinity, as well as declines in food supply in certain years.
4.2	Water	EIU calculation	A composite indicator that measures the health of fresh-water resources and how depletion might impact agriculture. Subindicators include: • agricultural water risk—quantity; and • agricultural water risk—quality.	
4.2.1	Agricultural water risk – quantity	WRI Aqueduct	A measure of the ratio of total annual water withdrawals to total available annual renewable supply. Data is based on the WRI's agriculture weighting scheme and is an average of baseline water stress, inter-annual variability, seasonal variability, upstream storage and groundwater stress.	Overall water availability may influence agricultural water supply.
4.2.2	Agricultural water risk – quality	WRI Aqueduct	A measure of the risk that water might be polluted. Data is based on the WRI's agriculture weighting scheme for return flow ratio and upstream protected land.	Water pollution may impact the quality and availability of water for agricultural purposes.
4.3	Land	EIU calculation	A composite indicator that measures the health of land, and how land degradation might impact agriculture. Subindicators include: • land degradation; • grassland; and • forest change.	
4.3.1	Land degradation	UN	A measure of the proportion of land that is degraded over total land area	Land degradation may impact the quality and availability of soil and arable land.
4.3.2	Grassland	FAO	A measure of greenhouse gas emissions from the drainage of organic soils (e.g. peatlands) under grassland (Net emissions/removals of CO_2, gigagrams).	Grasslands act as carbon sinks that help to maintain organic matter in the soil. Loss of grasslands may impact the quality and availability of soil and arable land.
4.3.3	Forest change	World Bank	A measure of the health of forests (change in forest areas as a percentage of total land area).	Forests help store groundwater and act as carbon sinks, preserving ecosystems. Loss of forests and ecosystems changes may impact agricultural productivity.
4.4	Oceans, rivers and lakes	EIU calculation	A composite indicator that measures the health of oceans, a crucial source of protein for many populations. Subindicators include: • eutrophication; and • marine biodiversity.	

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
4.4.1	Eutrophication	WRI	An assessment of the health of oceans. Qualitative measurement from 0-2.	Over-enrichment of oceans depletes oxygen, killing off aquatic life and disrupting ecosystems, which can ruin fisheries as well as agricultural production from saltwater areas.
4.4.2	Marine biodiversity	Yale Environmental Performance Index	A measure of the health of marine life represented by a country's total catch that comes from overexploited or collapsed stocks, considering all fish stocks within a country's exclusive economic zone. A score of 100 indicates that none of a country's fish catch come from stocks that are overexploited or collapsed, and a score of 0 indicates worst performance.	Falling fish stocks limit access to protein for populations whose diets are fish-dependent.
4.5	Sensitivity	EIU calculation	A composite indicator that measures how susceptible countries are to the depletion of natural resources and agricultural productivity. Subindicators include: • food import dependency; and • dependence on natural capital.	
4.5.1	Food import dependency	FAO	A measure of how dependent a country is on cereal imports.	If climate and natural resource risks negatively impact agricultural production, countries that are dependent on imports could become more vulnerable to food shortages as major agricultural producers limit food exports to feed their own populations.
4.5.2	Dependence on natural capital	World Bank	A measure of how dependent a country is on natural resources for economic output based on natural resource rents as a percentage of GDP. Natural resource rents are inclusive of oil, natural gas, coal (hard and soft), mineral rents, and forest rents.	In countries dependent on natural resources, natural resource shortages could impact the economy and affect incomes, making it harder to purchase food.
4.6	Political commitment to adaptation	EIU calculation	A composite indicator that measures the degree to which countries are creating systems and adopting practices to manage the risk that exposure poses to the agricultural sector. Subindicators include: • early warning measures / climate-smart agriculture; • commitment to managing exposure; • national agricultural adaptation policy; and • disaster risk management.	
4.6.1	Early-warning measures / climate-smart Agriculture	CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)	An assessment of commitment to developing early-warning measures for the agricultural sector and investing in climate-smart agriculture practices. The high-income countries that do not cover adaptation in their NDCs were given full credit based on proxy scoring. Qualitative measurement from 0-2.	Commitments to early-warning measures for agriculture can improve country resilience for climate and natural resource risks.
4.6.2	Commitment to managing exposure	CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)	An assessment of whether countries are committed to addressing agriculture-related climate exposure and natural resource management under the Nationally Determined Contributions (NDC). NDC mitigation measures include croplands, grasslands, forest management, degraded lands, coasts and peatlands. NDC adaptation measures include water management, soil, fisheries and aquaculture, and agroforestry. The high-income countries that do not cover adaptation in their NDCs were given full credit for adaptation measures based on proxy scoring. Qualitative measurement from 0-13.	National commitments to addressing exposure-related factors are a sign of political will and investments to mitigate these risks to agriculture.
4.6.3	National agricultural adaptation policy	Qualitative scoring by EIU analysts based on WHO, FAO and national health ministry documents	An assessment on if the country has a [current] national climate change strategy which covers adaptation for agriculture and/or food security.	Commitments to risk management practices for agriculture can improve country resilience for climate and natural resource risks.
4.6.4	Disaster risk management	UN	A measure of whether countries are coordinating their disaster risk management and their adaptation and mitigation measures. For countries not covered by the dataset, the EIU has undertaken qualitative research. Where information is not publicly available, the EIU has not given credit.	Adaptation and mitigation measures help to reduce the impact of natural disasters, which can impact both agricultural productivity and supply through storage, imports and exports.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
4.7	Demographic stress	EIU calculation	A composite indicator that measures the degree to which demographic stresses might increase countries' sensitivity to agriculture-related climate exposure and natural resource risk. Subindicators include: • projected population growth; and • urban absorption capacity.	
4.7.1	Projected population growth	UN	A measure of the forecasted population growth over the next five years.	Rapid population growth increases demand for food, straining food systems.
4.7.2	Urban absorption capacity	UN; EIU	A measure of the growth in a country's available resources (real GDP per capita) against the stress of urbanization (urban population growth rate). It is forward looking and is calculated as the %, forecasted 5-year growth in GDP per capita minus 5-year forecasted urban population growth. For countries with declining urban population, urban population growth is replaced with a zero in the calculation.	The capacity of a country to absorb the stresses placed on it by urban growth influences its ability to ensure food security.

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