Global Food Security Index 2021

The 10-year anniversary

Contents

Preface

The Global Food Security Index (GFSI) is the preeminent source of intelligence on the drivers of global food security. Developed by Economist Impact and supported by Corteva Agriscience, it evaluates food security in 113 countries across four key pillars: food Affordability, availability, Quality and Safety, and Natural Resources and Resilience. The index is based on a dynamic benchmarking model constructed from 58 qualitative and quantitative drivers of food security.

This report is a compilation of ten years of research conducted by Economist Impact between 2012 and 2021. Economist Impact combines the rigour of a think-tank with the creativity of a media brand to engage a globally influential audience. We believe that evidence-based insights can open debate, broaden perspectives and catalyse progress. The services offered by Economist Impact previously existed within The Economist Group as separate entities, including EIU Thought Leadership, EIU Public Policy, EIU Health Policy, Economist Events, EBrandConnect and SignalNoise. Along with framework design, benchmarking, economic and social impact analysis, forecasting and scenario modelling, we bring creative storytelling, events

expertise, design-thinking solutions and market-leading media products, making Economist Impact uniquely positioned to deliver measurable outcomes. Economist Impact 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. The GFSI 2021 model and the global research report are available online at http://impact.economist.com/ sustainability/project/food-security-index. Please visit the website for more information on the global rankings, key findings and 2021 methodology.

The project management team (Zubair Fattahi, Pratima Singh, Priya Bapat, Eve Labalme and Apurva Kothari) would like to extend our thanks to the experts, researchers, writers (Marianne Bray), editors (Paul Tucker) and graphic designers (Michael Kenny) who lent their expertise to this project.

A foreword from our sponsor

Over the past decade, the Global Food Security Index (GFSI) has evaluated the underlying drivers of hunger and malnutrition and revealed the policies and practices advancing food security worldwide.

The GFSI promotes conversation and collaboration among food-system stakeholders and provides evidence for decisive, meaningful action. The Index has supported policymakers, NGOs and others in their efforts to secure access to healthy, affordable food worldwide.

Corteva Agriscience's commitment to sponsoring the GFSI is rooted in our purpose: to enrich the lives of producers and consumers for generations to come. Together, we can achieve a resilient, food-secure world.

Executive summary

The ten-year anniversary of the Global Food Security Index (GFSI) allows us to look back over the past decade of data to inform action towards the UN Sustainable Development Goal of reaching zero hunger by 2030. This past decade has shown how important it is to look at hunger from a food-systems approach. This involves weighing up the affordability, availability, quality and safety of food, as well as assessing how resilient nations are in protecting their natural resources to enable them to keep producing food now and in the future.

Over the past ten years, new sub-measures have been added to the GFSI, reflecting the growing importance of markets, financial products, technology and innovation in enabling food security. At the same time, structural factors cannot be ignored, so the index weighs gender and income inequality, along with political and social risks posed by corruption and conflict. The existential threat of climate change is now also a major consideration. All of these measures reflect broader trends that have reshaped food security over the decade.

In assessing the specific drivers of food insecurity over ten years, the report presents the following key findings:

- After making rapid gains in the first few years of its inception, the GFSI scores across all nations peaked in 2019, before dropping over the past two years amid the covid-19 pandemic, conflict and climate variability.

- This drop in GFSI scores has been seen across all regions and nations in all the different income tiers. However, high-income nations in Europe still lead the index, as they did a decade ago, taking up seven of the top ten places, with Ireland getting top spot, scoring 84 (all GFSI scores are marked out of 100).

- Similarly, Sub-Saharan African nations continue to dominate the bottom ten spots on the index, taking up seven of these places, with bottom-scorer Burundi's score of 34.67 only 43% that of Ireland.

- The GFSI shows that hunger (using undernourishment as a measure) and stunting in children are most tied to the quality and safety of food. Populations with diets that lack quality protein and micronutrients, and where access to drinking water is limited, score worse in food security.

- Affordability is also closely linked to hunger. The GFSI shows that countries without comprehensive, well-funded national food safety-net programmes have higher levels of hunger (and stunting in children). Funding for these nets is the measure that has dropped the most over the decade, followed by a greater dependency on food aid.

- Greater volatility in food prices since 2019 have affected how affordable food is—70 countries slip in this year's GFSI rankings because of rising costs. Indeed, among the four pillars that make up the GFSI, Affordability has fallen the most over the decade.

- Natural Resources and Resilience is the lowest scoring pillar among the four categories of food security, dragging down the GFSI score overall. The countries in the index score only 50.8 out of 100 for this pillar, compared with a GFSI score of 60 across the board. While this is an improvement from 2012, it is only a slight rise from 50.1 in 2019, at a time when climate risks are taking centre-stage.

- Conversely, the highest scoring pillar is for Quality and Safety of food. The average score across all nations is 68, driven by the widespread adoption of nutritional plans or strategies. This is key because diet-related diseases are the primary cause of premature death globally.

- Finally, the Availability of food is ranked third after food Quality and Safety, and Affordability, with a score of 56.7. This is a jump from 53.4 in 2012; however, most of this rise came before 2019. While the overall Availability score is buoyed by a 41.5-point jump in crop storage facilities for all countries, it is dragged down by a drop in public expenditure on agricultural research and development (R&D).

- The countries that are models for food security are those that score highly on all four pillars of food security. For example, top-scorer Ireland scores above 92 points for Affordability, and Quality and Safety of food, and above 74 points for the Availability and resilience pillars.

- Over ten years, Ireland has been able to keep food costs down at the same time as tackling inequality and ensuring that a safety net remains in place. It has seen a big jump in agricultural R&D and has been able to minimise food loss, helping to ensure that enough quality food is available. The government also has high nutritional standards and is politically committed to adaptation.

- These trends have been replayed to some extent across the top ten most improved nations over a decade, which include countries like Tanzania, Oman and China, who have moved up because they have been able to tackle affordability, instil safety nets and boost market access. They have also cut back on volatility in production and committed to food security strategies and adaptation policies.

- Conversely, those nations that have deteriorated the most, like Venezuela and Burundi, have done so because they have been unable to keep food costs down, have not had sufficient food supply or market access, and have suffered from volatile production. The bottom ten nations have often not had the capacity to grow food security through investing in R&D, safety nets, food security strategies, national adaptation policies, risk management plans and nutritional guidelines. These policies, investments and regulations are essential to the construction of food-secure economies.

Introduction

This year marks a decade since the Global Security Food Index (GFSI) was first developed to better understand the drivers of persistent global food insecurity and serve as a resource for those engaged in addressing these challenges. The GFSI 2021 report is the culmination of ten years of research. This anniversary issue highlights the critical lessons that have been learned over the past ten years about global, national and regional-level food security and what this means for the future of the worldwide fight to end hunger and malnourishment, and its human, socio-political and economic impacts.

In 2016 the UN adopted an ambitious target as part of the Sustainable Development Goals (SDGs): to eliminate global hunger by 2030. Although the world had made substantial progress in reducing global hunger in the previous few decades, these gains are now stalled, and many have even been reversed. After a decade of progress, global hunger has steadily been on the rise every year since 2014.[1] Covid-19 has accelerated this decline, placing unprecedented strain on economic and food systems, increasing both the prevalence of chronic undernourishment and pushing millions of people into acute food insecurity.

The UN Food and Agriculture Organisation (FAO) estimates that the number of undernourished people rose from 690m in 2019 to 720m-811m in 2020.[2,3] (2020 was the first year for which the FAO has elected to put forth a range instead of a single value, owing to uncertainty surrounding the full impacts of covid-19.) Rather than making progress towards zero hunger, hunger has now risen to levels not seen since 2005-07. According to the FAO, if this trend continues, the number of people affected by hunger will surpass 840m by 2030, equivalent to 9.8% of the global population.[4] Although the covid-19 pandemic has contributed to this decline and has drawn increased attention to food insecurity, the decline in global food security started long before 2020.

Although it is now likely that ending hunger by 2030 is out of reach, this does not mean that making progress towards the goal should cease. Now, more

---

1   "Suite of Food Security Indicators," Food and Agriculture Organization of the United Nations, accessed October 1, 2021, http://www.fao.org/faostat/en/#data/FS.

2   "As More Go Hungry and Malnutrition Persists, Achieving Zero Hunger by 2030 in Doubt, UN Report Warns," Food and Agriculture Organization of the United Nations, July 13, 2020, http://www.fao.org/news/story/en/item/1297810/icode/.

3   Ibid.

4   "The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets" (Food and Agriculture Organization of the United Nations, 2020), https://doi.org/10.4060/CA9692EN.

To build a more sustainable, equitable, and healthier food system, the world must take stock of the way it produces, consumes, and thinks about food.

than ever, the world needs to take stock of what has worked to eliminate hunger and determine how these strategies can be deployed globally to both end persistent hunger and make economies and populations more resilient to the impacts of shocks such as covid-19. While the scale of the pandemic makes it potentially a once in a century event, there will certainly be more economic, climatic and geopolitical shocks in the future, necessitating food systems to be more resilient.

Global leaders have sounded alarm bells on hunger and the deficiencies of the current global food system and are calling for solutions. In 2019 the UN secretary general declared a "Decade of Action" to achieve the SDGs, including Goal 2, to achieve Zero Hunger by 2030. In September 2021 the UN hosted the Food Systems Summit to launch new actions, solutions and strategies to deliver progress on all 17 SDGs, each of which, the UN says, relies on a healthier, more sustainable and more equitable food system.[5] To achieve this new system, the world must take stock of the way that it produces, consumes and thinks about food, and implement meaningful change to build a food-secure world.

This transformation will require farmers on the 608m farms that exist globally to grow more food more efficiently and sustainably for the

8.5bn people that will live on earth in 2030.[6] Finite resources, such as land and water, are facing growing risk from climate change and associated impacts including floods, fires, droughts and extreme weather. To boost food security, approaches such as sustainable intensification seek to look at where innovation and technology can boost yields without taking up more land or causing environmental harm. Key to this approach is recognising that food is about more than just the environment and climate; it also involves social and economic criteria, such as self-sufficiency, equity, profitability, trade, the livelihoods of smallholder farmers and infrastructure.[7]

Through a retrospective assessment of the past ten years of the GFSI, this report aims to highlight lessons learned, alongside opportunities for investment and innovations to address the challenges of food insecurity. This will require looking at how national food security and climate adaptation plans, governance structures, welfare benefit systems, investment, research studies, and innovation enable food-secure environments. In this way, we can align the "Decade of Action" to achieve the SDGs by 2030 with the critical lessons to be learned from the past decade of the GFSI, pushing the needle forward on progress.

5   "The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets."

6   Sarah K. Lowder, Marco V. Sánchez, and Raffaele Bertini, "Which Farms Feed the World and Has Farmland Become More Concentrated?," World Development 142 (June 1, 2021): 105455, https://doi.org/10.1016/j.worlddev.2021.105455.

7   Mary Donovan, "What Is Sustainable Intensification?" (International Maize and Wheat Improvement Center, October 14, 2020), https://www.cimmyt.org/news/what-is-sustainable-intensification/.

Chapter 1: The GFSI and addressing the drivers of global hunger and malnutrition

Whereas most global food measures track outcomes and examine hunger, the GFSI looks beyond measuring hunger itself, and focuses on measuring its underlying drivers. This is critical for taking action to improve overall food security, as policymakers and investors need to understand not just where and when hunger and malnutrition levels are changing, but also where there are gaps in the underlying enabling environment for food security that can be acted upon and changed.

The GFSI is also conducted through the lens of a food systems approach. This approach looks at the interlinked solutions that will stop hunger from happening in the first place. It looks at what it takes

to produce, distribute and sell food in a complex society and economy, and amid a reality where climate change and resource scarcity pose severe threats to all parts of the food chain. To show the connection between all these links in the global, regional and local food systems, the GFSI looks at four categories of food security: Affordability, Accessibility, Quality and Safety, and Natural Resources and Resilience.

By analysing how indicators in these categories correlate with hunger outcomes and broader food security goals, policymakers can understand how investments and policies can improve outcomes. Whereas humanitarian and hunger-relief programmes are essential for preventing suffering in the short term, development programmes are key to lifting millions of farmers out of poverty and increasing local food security in the long term. Implementing new policies and making investments that prevent hunger and improve food security are critical to creating an inclusive and resilient global food system.

The GFSI has evolved since 2012, reflecting the need to consider a complex set of drivers across both developing and developed countries. Over the years, new indicators have been added to reflect the growing importance of innovation, technology and financial products in agriculture. Political tensions, growing inequality and climate crisis have been added into the equation to see what

How has the GFSI changed over time?

The GFSI has been updated since its inception in 2012, and now includes 58 indicators across four categories. These recognise the growing importance of:

- finance and finance products and market access;
- agricultural tech, data and innovation (from production to consumption);
- ensuring equality (in income and gender) in access to food, and agricultural education, resources and production;
- assessing political risks posed by corruption and conflict;
- noting political commitment to address climate change; and
- needing to protect natural resources.

impact they have upon people's ability to access the nutritious food needed to live healthy and active lives. The result is a document that provides policymakers, NGOs and decision-makers in the wider food-security community with the means to take informed, meaningful action to address hunger and malnutrition—and its consequences—globally.

The GFSI is a reliable gauge for understanding how food systems and hunger outcomes are connected

The GFSI scores are strongly correlated with hunger metrics. This means that high scores in the GFSI correspond with low levels of different dimensions of hunger, and low scores in the GFSI correspond with high levels of hunger. For example, Table 1 below shows that a high level of hunger (undernourishment) and a high percentage of children with stunted growth are strongly linked with a low score for food security.

Assessing changes in the GFSI scores and assessing the underlying factors is a useful way to understand what is driving hunger levels and to take informed action to address these.

Drivers of global food security are not being addressed: progress is slowing or stagnating even in high-income countries

During the first eight years of the GFSI, progress was being made, with global average scores steadily improving over time. However, in the past two years, scores have dropped marginally and gains plateaued. While covid-19 has drawn increased attention to the challenge of food security, the underlying challenges extend far beyond the pandemic. Progress in the countries that need the most improvement has continued but slowed. Low-income countries had an average increase of 3.5 percentage points in 2012-16. In 2017-21 the average has fallen to 0.2 percentage points.

Table 1: Correlations with GFSI 2021

Indicator	Definition	Correlation
Prevalence of undernourishment	(FAO) Estimate of the proportion of the population whose habitual food consumption is insufficient to provide the dietary energy levels that are required to maintain a normal active and healthy life	-0.87
% children stunted	(UNICEF/WHO) Percentage of children under five years who have a height-for-age below minus two standard deviations from the reference median	-0.86
% of children underweight	(UNICEF/WHO) Percentage of children under five years who have a weight-for-age below minus two standard deviations from the reference median.	-0.63
Prevalence of severe food insecurity	(FAO) Proportion of people who have experienced severe food insecurity in a population. People who experience severe food insecurity run out of food and, at the most extreme, have gone days without eating.	-0.70
Prevalence of moderate or severe food insecurity	(FAO) Proportion of people who have experienced moderate or severe food insecurity in a population. People who experience moderate food insecurity have reduced the quality and/or quantity of their food and are uncertain about their ability to obtain food due to lack of money or other resources.	-0.83
Prevalence of obesity	(WHO) Percentage of the population over 18 years of age that is obese. Obesity is defined as having an age-standardised body mass index (BMI) greater than 30.0.	+0.62

Stagnation is not just a result of slow progress by low-income countries. High-income countries which had previously made substantial gains are slowing, and even declining in terms of their overall food security environment. In 2012-16, over 80% of countries (30 of 36) increased scores. However, in 2017-21, two-thirds of high-income countries (24 of 36) have seen decreased scores in the GFSI.

The biggest drag on GFSI scores across all countries over the decade relates to how countries have fared when it comes to protecting natural resources and building up resilience to the climate crisis. All nations, whether high- or low-income, have significant room for improvement in this area: whereas the overall average GFSI score for all 113 nations is 60.9 in 2021, the average score for the Natural Resources and Resilience pillar is 10 points lower, at 50.8.

GFSI average overall score, global 2012-2021
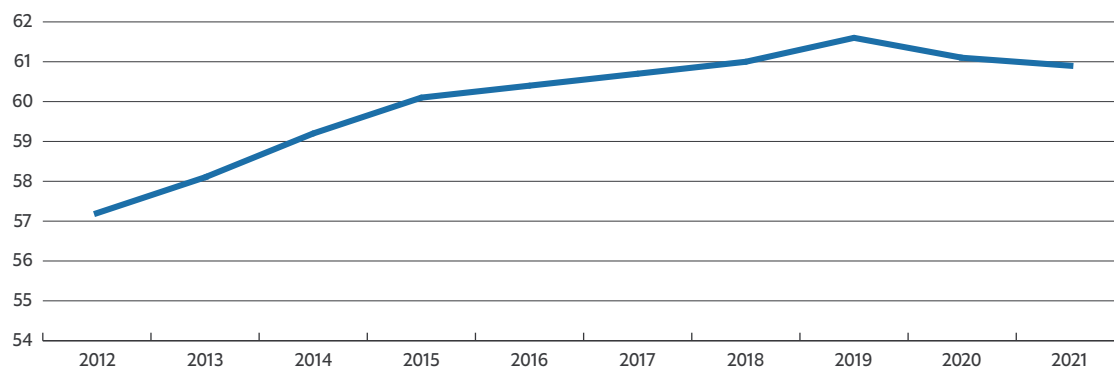
Source: The EIU, Global Food Security Index 2021

Table 2
Top ten highest and lowest performing countries in the 2021 Index

Overall food security environment: top- and bottom-ten ranking countries in 2021

Best performers	2021 score	Worst performers	2021 score
Ireland	84	Burundi	34.7
Austria	81.3	Yemen	35.7
United Kingdom	81	Mozambique	35.9
Finland	80.9	Sudan	37.1
Switzerland	80.4	Malawi	37.3
Netherlands	79.9	Ethiopia	37.6
Canada	79.8	Haiti	37.8
Japan	79.3	Syria	37.8
France	79.1	Zambia	38
United States	79.1	Sierra Leone	38.1

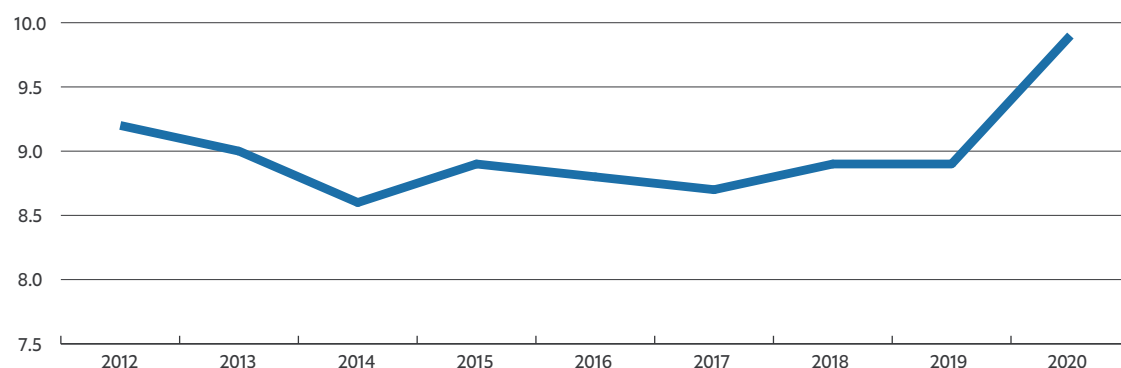## Table 3
Top 5 most and least improved countries

Most-improved and least-improved countries between 2012 and 2021

Most improved	Score change	Least improved	Score change
Tanzania	+13.3	Venezuela	-9.9
Oman	+11.9	Brazil	-4.8
Algeria	+10.9	Burundi	-4.5
China	+9.6	Norway	-3.4
United Arab Emirates	+9.6	Syria	-3.4

Prevalence of undernourishment, global (%)

Source: FAO Suite of Food Security Indicators.[8]

The decline in GFSI scores corresponds with a rise in the state of food insecurity

In 2020, undernourished people made up 9.9% of the world's population, only slightly more than ten years ago but a marked jump from 8.9% in 2019. The WHO also estimated that, in 2020, more than 2.3bn people (about 30% of the global population) lack year-round access to adequate food.[9] The indicator measuring this phenomenon, prevalence of moderate or severe food insecurity, experienced a 5-year record decline of 3.8 points in 2020. This is happening despite the fact that the collective global ability to produce food has increased by 300% over the last 50 years and more than one-third of all food is thrown away.[10]

Hunger has a long-term economic impact. The World Bank says the economic costs of undernutrition, in terms of lost national productivity and economic growth, are significant—ranging from 2 to 3% of GDP in some countries and up to 11% of GDP in Africa and Asia each year.[11]

The role of structural inequality

Today's food systems are characterised by unequal access to nutritious food. Diet-related disease remains the primary cause of premature mortality globally, and about 2bn people are obese.[12] A 2016 policy paper by the Global Panel on Agriculture and Food Systems for Nutrition estimated that the direct costs of treating obesity and undernutrition (including stunting, wasting and micronutrient deficiencies) were between US$1tn and US$2trn globally.

---

8   "Suite of Food Security Indicators."

9   "UN Report: Pandemic Year Marked by Spike in World Hunger" (World Health Organization, July 12, 2021), https://www.who.int/news/item/12-07-2021-un-report-pandemic-year-marked-by-spike-in-world-hunger.

10 "Dr. Kalibata's Message on Building Sustainable Food Systems," Harvest Newsletter (Alliance for a Green Revolution in Africa, February 6, 2020), https://agra.org/ourharvest/january-20/dr-kalibatas-message-on-building-sustainable-food-systems/.

11 "The World Bank and Nutrition," World Bank, accessed October 1, 2021, https://www.worldbank.org/en/topic/nutrition/overview.

12 "Dr. Kalibata's Message on Building Sustainable Food Systems."

Prevalence of moderate or severe food insecurity, global (%)
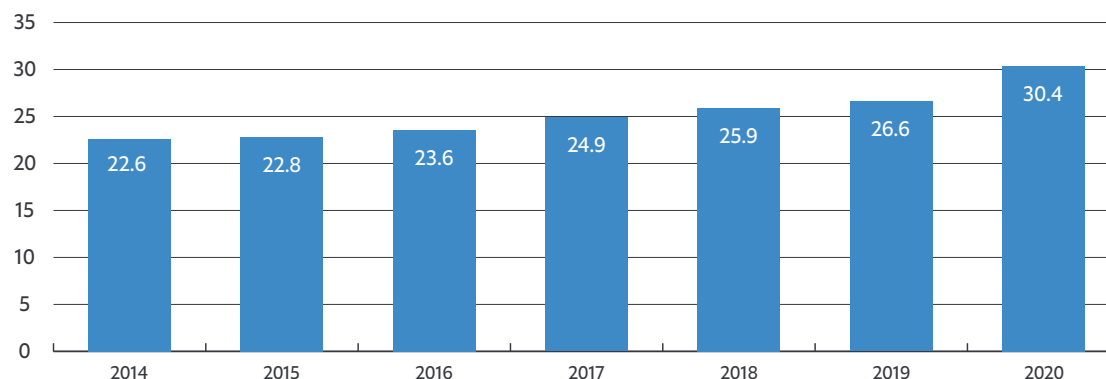
Source: FAO Suite of Food Security Indicators.[13]

Alongside the prevalence of hunger and unequal access to nutritious food, the GFSI looks at the importance of gender inequality, capturing disparities in health, education, political capital and economic power, and ultimately food security. This is particularly important, as a GFSI analysis showed that gender inequality was closely tied to both the prevalence of hunger and stunting in children under the age of five.

Nearly all (96%) countries have improved their scores in combating gender inequality since the GFSI started. But there is a wide chasm between top scorer Switzerland, at 97.5, and lowest scorer Yemen, which has reached just 20.5 points out of 100. Regional disparities are at play, with eight of the top ten scorers from high-income European countries and eight of the bottom ten from Sub-Saharan Africa. The top five most improved countries since 2012 are from the Middle East, while Haiti's score on gender inequality deteriorated the most over a decade.

These structural inequalities, combined with the compounding effect of covid-19 and climate change risks, are leading to a heightened risk of

food insecurity and a rise in the proportion of people suffering from it. This is putting pressure on policymakers to act amid a flurry of diplomatic activities, including the UN Food Systems Summit in September 2021 and the COP26 climate change talks in Glasgow later in the year.

Structural inequalities, combined with the effect of covid-19 and climate change risks, are leading to a heightened risk of food insecurity and a rise in the proportion of people suffering from it.

---

13 "Sustainable Development Goals: Indicator 2.1.2 - Prevalence of Moderate or Severe Food Insecurity in the Population, Based on the Food Insecurity Experience Scale," Food and Agriculture Organization of the United Nations, accessed October 1, 2021, http://www.fao.org/sustainable-development-goals/indicators/212/en/.

Chapter 2: Key drivers of change in GFSI scores

To effectively address the underlying drivers of food insecurity, we need a better understanding of where countries have improved and where action needs to be taken. This section will explore specific dimensions and countries within the GFSI.

To counter hunger, malnutrition, food insecurity and obesity requires that affordable, accessible, safe and nutritious food be produced in an actively managed food system that is resilient to shocks

The GFSI shows that not being able to afford food is closely tied to people going hungry and to children under five being stunted. This is especially true if a population is living in poverty and incomes are very unequal. Huge price swings for food are a big threat, especially for the poor, and the inaugural GFSI report in 2012 predicted that these fluctuations could persist over the decade. The 2007-08 world food crisis saw excessive price volatility for wheat, maize, soybean and sugar. But prices stabilised between 2012 and 2018, as mirrored in the index—the ranking of most countries (89) in the GFSI has improved in 2021 versus 2012 when it comes to food costs. However, from 2018 onwards excessive price volatility emerged for wheat, rice, cocoa, coffee and sugar, curbing the preceding gains.[14] This led to a dramatically different picture emerging in 2019—the GFSI showed that 62% (70

countries) slipped in the rankings that year because of rising food costs, and the average score for this indicator has dropped from 79.9 in 2019 to 70.4 in 2021.

Price swings disrupt markets and have downstream effects on traders, processors and consumers along the food chain. For the poor, it affects their ability to afford food or buy what is needed to produce food. Indeed, while Affordability scores in the GFSI improved on average from 2012 to 2016, they have slumped in the past five years. Similarly, most of the progress on poverty was made in the first five years of the index and not the second five.

Safety nets are closely linked to stemming hunger, but just under half of countries are having problems funding support programmes

Policymakers are limited as to how they can react to price rises and volatility, and they rely on programmes such as food safety nets to support consumers when shocks occur. Strengthening these safety nets ensures that vulnerable families have access to food and water—and money in their pockets to buy necessities. Support can come in the form of food vouchers, cash transfers or school meal programmes, and governments have increasingly relied on these during covid-19.

---

14 "Excessive Food Price Variability: Coffee," IFPRI Food Security Portal, September 16, 2020, https://www.foodsecurityportal.org/coffee-price-volatility-alert-mechanism.

Proportion of population under global poverty line (2012-2021)

—— Global average for indicator 1.2) proportion of population under global poverty line, 2012-2116
—— Global average for indicator 1.2) proportion of population under global poverty line, 2016-2121
- - - Trend line based on 2012-2016 data
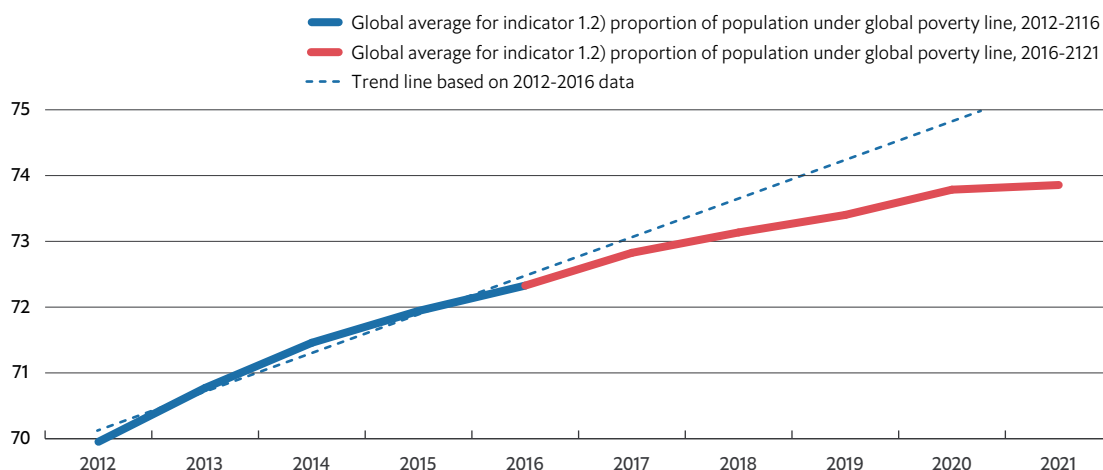
Source: The EIU, Global Food Security Index 2021.

Using food safety nets to absorb shocks is particularly important—GFSI analysis showed that higher rates of malnourishment and stunting in children correlate with countries not having well-functioning food safety nets in place.

The GFSI shows that more countries have food safety nets now than ten years ago. In 2012 ten countries had no support in place, including five from Sub-Saharan Africa. In 2021 all but three countries (Yemen, Syria and Chad) had food safety nets, showing how widespread their use is. Although many different types of programmes exist, policymakers generally agree that governments providing transparent, stable, well-targeted support programmes will best withstand the test of unexpected economic shocks and other crises.

However, funding these safety nets has become more difficult, particularly during the covid-19 pandemic, one of the biggest economic, health and social crises in recent history. The number of countries that had problems funding their safety nets jumped from 36 in 2019 to 47 in 2020 and 51 in 2021, showing that just under half of countries on the GFSI are facing inconsistent funding or

facing funding reductions that are hampering progress. Not surprisingly, the biggest drag on the average GFSI score over ten years was funding for safety-net programmes. This was coupled with an increased dependency on food aid, the second biggest drag on the overall index.

Coverage also varies within countries. National programmes are considered the most favourable, but for just over a third of countries (39) their programmes did not cover the full country or were only available in parts of the country or specific groups. Interestingly the number of countries that rely on donor or non-governmental supported programmes has dropped over the past year, perhaps because national governments have had to step in to operate the safety nets amid the pandemic.

Food security drivers still follow regional and income level patterns, showing some countries and regions need more exponential growth

Food insecurity is growing globally, and no region is immune. According to the UN's *State of Food Security and Nutrition 2021* report, the prevalence

of undernourishment has continued to grow in Asia, Africa and Latin America. The GFSI shows that these regions have not gone through the exponential improvements that would be needed to improve the underlying food security environment.

Asia is the world's most populous region and more than half of the world's undernourished—418m people—live there. The GFSI has shown only modest improvements in scores for Asia over the past decade, and most of this happened in the first

five years of the index. None of the countries in the region have food security scores above 80, which is surprising given that it includes countries like Japan and New Zealand.

More than 282m undernourished people live in Africa, and the number is growing faster than in any other region of the world.[15] Nineteen-point-one percent of Africans are undernourished, more than twice the world average, and the highest among all regions.

Prevalence of undernourishment by region (%)
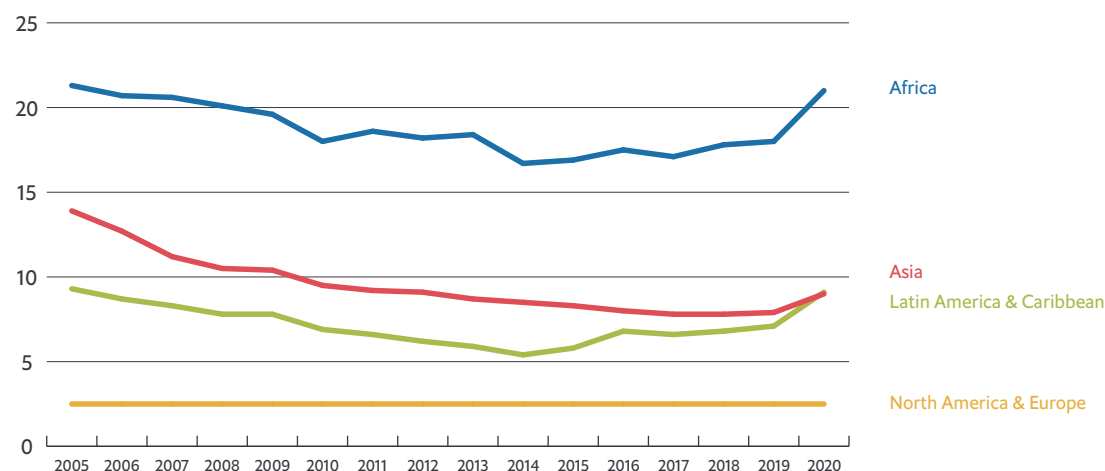
Source: UNDESA, SDG Indicator Database, Target 2.1.1 (2021)

Overall score by region, 2012-2021
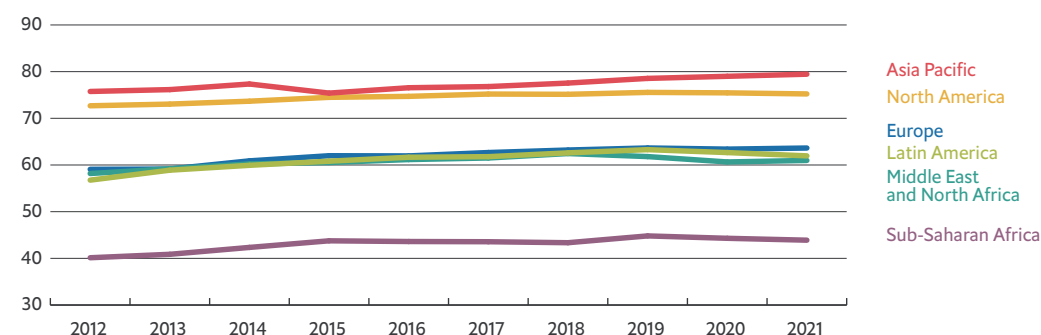
Source: The EIU, Global Food Security Index 2021.

---

15 "The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets."

Overall score by income levels, 2012-2021
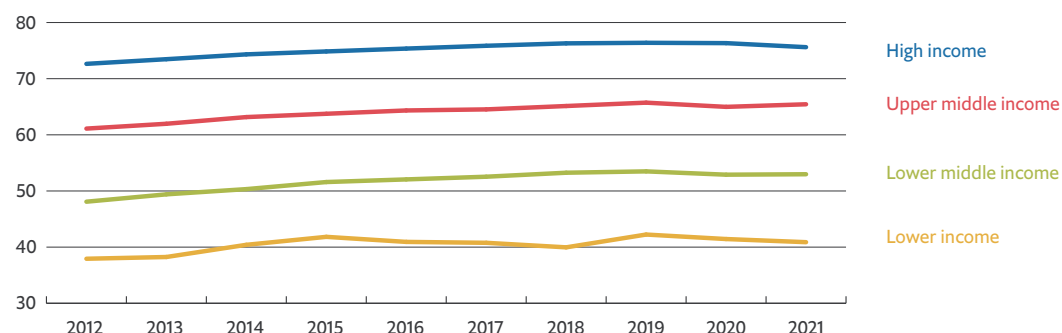
Source: The EIU, Global Food Security Index 2021.

Natural Resources and Resilience are dragging down GFSI scores across the board

Countries scored the worst on the natural resource risk and resilience to climate change pillar in 2021. This dragged down the GFSI, with the average score in this area coming in at 50.8 points. This finding follows the publication of an Intergovernmental Panel on Climate Change report in August 2021 that said the impacts of warming are coming faster than expected, with rapidly increasing, simultaneous

Food systems alone contribute to 25% of greenhouse gas emissions and 75% of biodiversity loss, and a global consensus is emerging around needing to adopt mitigation strategies.

extreme weather events having serious effects on food supply, creating pressure on policymakers to act. Food systems alone contribute to a quarter of greenhouse gas emissions and three-quarters of biodiversity loss, and a global consensus is emerging around needing to adopt mitigation strategies.

Water quality and availability emerge as key concerns in 2021, with the average score for all countries coming in at 19.7, followed by 27.4 on the health of oceans, rivers and lakes. This raises concerns around the health of freshwater resources, and how water pollution and depletion might impact water quality and agriculture. The health of oceans is also a consideration, as the sea is a crucial source of protein for many. The GFSI gave very low ratings across the board in terms of nations catching fish that are not from overexploited or collapsed stocks, although 61 countries have improved their sustainable fishing practices since the index began.

The fifth-worst driver across the entire index in 2021 is political commitment to adaptation, which averages 45.3 points. This indicator is key to assessing the extent to which countries are creating systems and adopting practices to manage the risk that climatic changes pose to agriculture. While the extent of commitment to adopting early warning measures or investing in climate-smart agriculture is difficult to determine (the index is based on a single data projection for this), 27% (51 of 113 nations) have improved their scores by adopting a national agricultural adaptation policy. Another 21 countries have co-ordinated disaster risk management through adaptation and mitigation plans.

Nations score best on the Quality and Safety of food, with big jumps in nutritional standards

Nations scored best when it came to food Quality and Safety, a broad category that looks at how nutritionally diverse diets are, the quality of protein, how many micronutrients are available, what sort of nutritional standards are in place and whether food is stored safely. This is an especially important pillar of food security, as GFSI analysis shows that it has the strongest link to hunger and stunting in children. Being able access to quality protein, micronutrients and safe water are closely tied to combating hunger and stunting. The average score is 68 for this category in 2021, making it the top-scoring pillar out of all four in the index; the score has risen from 62.9 in 2012.

Although the quality of food has changed little in 2021-21 across the 113 countries included in the GFSI, nutritional standards have increased by an average of 10 points. The biggest driver came from countries adopting and publishing a national nutrition plan or strategy, a necessary step to prevent and control malnutrition in both adults and children, and to accelerate progress towards set goals. Interestingly, most of this progress came in the first five years of the index, with scores jumping by 25 points, before dropping 14.2 points in the past five years.

A second driver in the relatively high overall score for food Quality and Safety is the rise in the ability to store food safely, which has risen by 6.9 points for all countries over the decade. Indeed, the biggest score change over all countries is improvements to crop storage, which has jumped 41.5 points. Key to storing food safely is being able to refrigerate it, and the GFSI shows that more people now have access to power. The global average for the proportion of national populations with access to electricity has increased from 77.6%

in 2012 to 84.1% in 2021. This has led to a rise in score from 76.3 to 83.2 over the past decade, with 70 nations improving their scores in this respect.

On the rise, too, is access to (at least) basic drinking-water services. Having water is essential for food safety, as it is involved in everything from washing produce to enabling food workers to wash their hands. Whereas 83% of people across the 113 GFSI countries had access to basic drinking water services in 2012, this has jumped to 87.2% in 2021, and nearly three-quarters of countries score better in this area in 2021 than they did in 2012.

However, mitigating the rise in the food safety scores was a significant drop in countries' self-reported assessment on how well their systems are able to respond to keep food safe, including through existing laws and food recalls. This drop was more recent, with scores slipping from 79.3 in 2017 to 69.2 in 2021; more than half the nations in the index submitted reduced scores. Given the covid-19 pandemic, food safety has become more important—policymakers should take note.

Yemen, Venezuela and Colombia show how critical economic and political stability are to food security

Food security cannot exist without stability. Yemen and Venezuela provide clear examples of the symbiotic ties between conflict and hunger.

Yemen

Even before fighting broke out in 2015, Yemen was one of the most food-insecure nations in the world. In 2012 Yemen scored 35.8 out of 100 on the GFSI, and ten years later little has changed, with the nation ranking second-to-last, after Burundi. Furthermore, Yemen is the only Index country that has received chronic food aid every year since 2013. The UN World Food Programme (WFP) says that 16.2m Yemenis are food insecure (more than

half of the country's population), and the WFP's mission to feed nearly 13m each month is its largest emergency response globally.[16]

Five years of conflict between the government and Houthis has killed thousands of civilians and left 4m people displaced.[17] The situation is very unstable, with high political and social barriers to food access. Whereas 38% of Yemenis were living in poverty in 2012, ten years later the GFSI shows that just over half of its population live under the poverty line. Of further concern, there is vast income and gender inequality in the country.

Yemen is one of only three nations in the GFSI that lacks a food safety-net programme. The cost of a month's supply of food has skyrocketed by more than 250% since 2015, pushing Yemenis to the brink of famine.[18] Yemenis are around half as likely as the GFSI average to have access to quality protein and safe food.

The impact of the war on the country's infrastructure has been devastating. The nation cannot supply its own food to feed its population, making it highly dependent on food imports. But Yemen's main airport, located in the capital, Sana'a, has remained closed for a fifth year, blocking goods from entering the country.[19] Yemen has

no agricultural infrastructure to speak of, with the GFSI giving the country a score of zero for crop storage facilities, and road, air, port and rail infrastructure.

Without political stability, Yemen is able to achieve little in the way of food governance—there is no food security agency or strategy, nor does the country have national dietary guidelines, plans or strategies, or nutrition labelling. Meanwhile, its political commitment to adaptation has waned, with the country ceasing its national adaptation policy. In addition, the country has no disaster risk management in place, leaving it exposed to climate change.

Venezuela

Venezuela stands out for having the most deteriorated food security environment in the world since 2012, something that has happened in step with the country experiencing the world's worst economic meltdown of the period. The economic situation in Venezuela has deteriorated so quickly that the World Bank has removed the nation from the upper middle income tier, and has yet to assign it to another grouping.[20] Over ten years, the oil-rich nation has slipped from 78th place in the GFSI, with a score of 49 in 2012, to 103rd in 2021, with a score of 39.2. Food supply adequacy has decreased more than anywhere else in the world (from having 124% of the necessary calories per person to having only 91%), while prices have skyrocketed to incomprehensible levels, with the GFSI showing the change in food costs in 2021 jumping to 4,559 times higher than in 2012.

Although a food safety net is in place, the subsidy

---

16 "Yemen Emergency," World Food Programme, accessed October 1, 2021, https://www.wfp.org/emergencies/yemen-emergency.

17 "Yemen," World Food Programme, accessed October 1, 2021, https://www.wfp.org/countries/yemen.

18 "Price Hikes and Currency Freefall Push Yemen's Children Further into Hunger" (Save the Children via ReliefWeb, August 16, 2021), https://reliefweb.int/report/yemen/price-hikes-and-currency-freefall-push-yemen-s-children-further-hunger-save-children.

19 Sultana Begum, "Five Reasons Why Yemen's Sana'a Airport Must Reopen," Norwegian Refugee Council, August 5, 2021, https://www.nrc.no/perspectives/2021/five-reasons-why-yemens-sanaa-airport-must-reopen/.

20 Nada Hamadeh, Catherine van Rompaey, and Eric Metreau, "New World Bank Country Classifications by Income Level: 2021-2022," World Bank Blogs (blog), July 1, 2021, https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2021-2022.

scheme has been denounced by US officials as being plagued by corruption.[21] Indeed, the GFSI scores the Latin American nation as having high levels of risk of corruption. Nearly one in five of the 24.8m people in Venezuela live below the poverty line. The WFP says that one in three Venezuelans are food insecure, including 2.3m who are severely food insecure.[22,23] And while having strong market and financial product access can help farmers in need, the markets seem to have failed in Venezuela. The GFSI shows that there is no access to savings or credit and no diversified financial tools that could help farmers survive crises with crop insurance or price hedging, while access to market data and mobile banking has almost halved since 2012.

Alongside the food affordability crisis, Venezuela is experiencing big problems with the availability of food, with most indicators falling since 2012. Alongside the huge deterioration in the sufficiency of supply, there is vast volatility in agricultural production—this has increased nearly three-fold in ten years. Political and social barriers to access have also jumped, with higher risks of armed conflict and political instability, alongside a high risk of corruption and widespread gender inequality. Food loss has also risen amid a drop in the quality of air, port and rail infrastructure.

In addition, there is limited political commitment to food security, either through a dedicated agency or strategy, and nutritional standards were dropped after 2016. Agricultural research and development have also decreased. Despite high risks of temperature rise and water shortages amid a climate crisis, Venezuela has no national policy on adaptation, nor disaster risk management. This is a big concern as demographic stress adds pressure to the situation.

Colombia

Colombia provides an example of how ending conflicts can lead to reducing hunger. A peace pact signed between Colombia's government and the country's main armed opposition group in 2016 largely put an end to six decades of conflict. The conflict killed hundreds of thousands of people, displaced 7.5m and was marked by widespread human-rights violations. Although the GFSI shows that the political and social barriers to food access in this nation of 50m people are still higher than the norm across 113 countries, hunger has decreased. In 2010 about 12.2% of the population was hungry; the estimate for 2018 is 5.5%.

Colombia has reduced food costs, more than doubling its score in this regard from 2017 to 2021, and saw a fall in the proportion of its population living in poverty from 2016 to 2020, although this has risen in the past year. The country has also seen a significant increase in market access and agricultural financial services, especially in the number of mobile subscribers per 100 inhabitants, which has risen from 117.8 in 2016 to 131.7 in 2021. And after suffering a year of high volatility of agricultural production in 2016, volatility has since dropped by 80%.

Despite overall negative trends in global food security, some countries have made significant strides in reducing hunger and food insecurity over the past ten years

The top ten most improved nations on the GFSI over ten years moved up the rankings by making significant inroads in the affordability of food. Six of them, including China, Cambodia and Kenya, did this by driving down food costs and boosting

21 "UN to Provide Food to Venezuela Children amid Crisis," BBC News, April 20, 2021,
       https://www.bbc.com/news/world-latin-america-56814495.
22 "2021 Global Report on Food Crises" (World Food Programme, May 5, 2021),
       https://www.wfp.org/publications/global-report-food-crises-2021.
23 "Bolivarian Republic of Venezuela," World Food Programme, accessed October 1, 2021,
       https://www.wfp.org/countries/venezuela-bolivarian-republic.

Table 3: Biggest changes in the overall food security environment 2012-21

Most-improved countries	2012 score	2021 score	Δ	Least-improved countries	2012 score	2021 score	Δ
Tanzania	34.7	48.0	+13.3	Venezuela	49.3	39.4	-9.9
Oman	58.1	70.0	+11.9	Brazil	65.4	60.6	-4.8
Algeria	53.2	63.9	+10.9	Burundi	39.2	34.7	-4.5
China	61.7	71.3	+9.6	Norway	79.4	76.0	-3.4
United Arab Emirates	61.4	71.0	+9.6	Syria	41.2	37.8	-3.4
Russia	65.4	74.8	+9.4	Rwanda	43.6	40.3	-3.3
Cambodia	43.8	53.0	+9.2	Malawi	39.5	37.3	-2.2
Pakistan	45.7	54.7	+9.0	Mozambique	37.7	35.9	-1.8
Kenya	38.3	46.8	+8.5	Portugal	76.7	75.2	-1.5
Paraguay	53.1	61.6	+8.5	Haiti	38.7	37.8	-0.9

market access, implementing food safety nets, and reducing poverty. Another three—Algeria, the UAE and Pakistan—made improvements on the back of big gains in Availability, made by slashing volatility in production, boosting self-sufficiency in food supply and committing to food security. Meanwhile, Russia made big gains in the Natural Resources and Resilience pillar because of its political commitments to adaptation.

GFSI analysis of the ten nations that have moved up the most in food affordability over the decade shows that being able to cut food prices has been the biggest driving factor for eight of them, a grouping that includes Kenya, Tanzania and Uganda. For the other two—Oman and Cambodia—launching a safety net has made the biggest difference. Boosting market access has also been a key step for the top six nations.

The UAE, Algeria and Niger lead the ten most-improved nations in boosting food availability. For six of these nations, the biggest contribution has been tackling volatile food production, while for another four, it has been committing to food security policies and access. Many have also scored better as a result of bolstering their infrastructure. Seven have shown

growth in agricultural research and development, albeit sometimes from a low base. This shows how political commitment and investment go hand-in-hand to enable food security.

Increasing the availability of food supply is associated with drastic decreases in hunger. Bolivia, Ethiopia and Angola are all countries that formerly received below 100% of adequate food supply and now have above 100%. The prevalence of hunger has been steadily reducing in Bolivia, dropping from around 28% in 2000-02 to 15.5% according to the most recent estimate. A combination of poverty reduction and investing in farmer productivity has improved overall food security.

Introducing standards and policies are the main drivers of change in the final two pillars of the GFSI—Quality and Safety, and Natural Resources and Resilience. Sudan, Serbia and Uruguay have improved the most in terms of Quality and Safety. Putting in place nutritional standards has been the biggest driver for eight of the top ten highest-scoring nations in this category. This shows that countries are becoming more committed to setting national standards, including dietary guidelines, nutrition plans and monitoring.

When it comes to the Natural Resources and Resilience pillar, political commitment to adaptation is the key reason for ranking rises in nine of the top ten nations, led by Togo, the UK and Poland. This measure looks at the degree that countries create systems and adopt practices to manage the risk that climatic changes pose to agriculture. All of the most improved nations in this pillar also performed better in terms of demographic stress, indicating that their population growth may be slowing down, or the capacity of the country to absorb the stresses placed on it by urban growth is getting better. Many countries also saw an improvement in the overall health of their oceans, rivers and lakes.

Overall, Tanzania and Oman are the two countries that have seen the most improvements in the GFSI from 2012 to 2021.

Case study: Tanzania

In the first ten years of the GFSI, Tanzania has the most-improved food security environment, with its score increasing by 12.2 points, to 47; the country has risen 19 places in the ranking since 2012, rising to 90th position. Although Tanzania still stands below the average across the 113 nations for three of the four pillars—for example, the country's Affordability score is 41% below the global average. —it has made major inroads in slashing food costs, lifting its population out of poverty and increasing food supply. Rises in food prices have slowed to a quarter of their rate of change in 2012, and 7% of Tanzanians have risen out of poverty. The nation, which is dominated by smallholder farming, saw the number of mobile subscribers per 100 people nearly double over ten years, expanding access to market data and mobile banking.

Tanzania's availability of food is now on par with other nations in the GFSI. Its biggest improvements over the past decade have come in reducing volatility in food production, which ensures a steady flow of food and a lesser likelihood of price rises. Production volatility has dropped to a quarter of what it was in 2012, reaching a level well below the global norm.

This rise in availability has come in tandem with a greater supply of food. Tanzanians are now much more likely to meet their daily dietary needs, with the nation, populated by 55.9m people, gaining 33.7 points for these efforts over the past ten years. The country has also improved its crop storage facilities, earning it a top score for this and enabling more people to store food safely—the percentage of the population with access to electricity has more than doubled over ten years. This has helped to reduce Tanzania's need for food imports and its dependence on natural capital. Tanzania is also the first country to host a field innovation hub with the WFP to test and refine ideas that would contribute to achieving the SDGs.

Looking ahead, Tanzania needs to work on its food-systems governance. The nation has both a food security strategy and agency, but its food safety-net programme is facing funding difficulties and does not cover the full country. It has also dropped its national adaptation policy, and only 17% of local governments are adopting and implementing local disaster risk reduction strategies in line with national plans. These disaster management and social protection plans help to protect the most vulnerable, especially as Tanzania attracts refugees from neighbouring Burundi and the Democratic Republic of Congo.

Case study: Oman

Oman is the second most improved nation in the GFSI since the index was launched in 2012—its score has increased by 12 points, from 58.4 to 69.4 points in 2021. Over the past ten years the sultanate has ramped up its social protection and food security programmes, and also worked on bolstering market access and infrastructure, making food more affordable for its 4.5m people.

Oman's category scores for Affordability and Quality and Safety of food now far exceed the global average. The rise has come as the high-income nation has made food more affordable—food costs have dropped by 72% since 2021. And although almost no Omanis live in poverty and there is no dependency on food aid, the government still set up a food safety-net programme, which from 2014 has received the highest score for its funding, coverage and operation. This good governance carries to other areas—Oman has a food security strategy, and has introduced nutritional standards, including setting up national guidelines and a nutrition plan, all of which have helped its score to jump to 76.5 points. The country also has a national agricultural adaptation policy.

Oman has enabled strong market access, especially for finance and diversified financial products for farmers. The mobile-phone penetration rate is also high, enabling access to market data and mobile banking. There is also strong road infrastructure, and crop storage facilities have improved in the past ten years.

Oman is not immune to vulnerabilities: it is almost completely dependent on imports, is highly exposed to temperature rises and droughts, and has concerns over having enough water. Yet, in its 2011-15 economic development plan, the oil-rich sultanate said that it would diversify from oil production, investing $4.9m in agriculture and fisheries-related infrastructure projects. It is also working on a fisheries plan with the World Bank.[24]

Oman has set a target of 100% of self-sufficiency in food security by 2040. [25] The government's food-sector investment and development arm, the Oman Food Investment Holding Company said in July 2021 that it will invest around US$1.2bn over six years in projects such as a camel milk farm, a food logistics scheme, a vertical farm and an animal aqua feed facility.

---

24 Banu Setlur and Michael Willis, "Sustainable Management of the Fisheries Sector in Oman: A Vision for Shared Prosperity," Text/ HTML (Washington, D.C.: World Bank Group, January 12, 2015), https://www.worldbank.org/en/country/gcc/publication/sustaina- ble-management-of-the-fisheries-sector-in-oman-a-vision-for-shared-prosperity.

25 Sonal Devesh and Abdullah M. Asrul Affendi, "Food Security Dynamics in Oman: VECM Approach," Advances in Dynamical Systems and Applications 15 (December 30, 2020): 249–63, https://doi.org/10.37622/ADSA/15.2.2020.249-263.

Investments in food security must be sustained over time to address both present and emerging future threats

A number of threats are adding pressure to an already stressed and compromised food system. These threats can be external in nature, such as pandemics and climate change, or they can be internal, like insufficient production or high population growth. For example, the GFSI shows close links connecting high population growth and demographic stress with hunger and stunting in children. To meet existing and emerging future threats requires that investments in food security are sustained—from innovation in climate-adaptive crop varieties to setting aside money to target programmes to the most vulnerable.

Reduced public investment in agriculture R&D is a major contributor to poorer performance by high-income, top-performing countries

Over the past decade, many high-income and top-performing countries have either declined or stagnated in their overall food security score, as reflected in only a very minor average increase of 2.97 points for the 36 nations in this grouping.

There is no doubt that this group of nations has made significant advances in policy commitments since 2012. However, performance in all other areas of the index has been unimpressive, with the biggest decline in scoring coming in public expenditure on agricultural R&D. This cut in R&D spending was the biggest drag on the overall score, with the 36 nations dropping an average of 7.75 points in 2012-21, much larger than the 2.6-point drop for all countries across the board.

This indicator measures how much a government spends on agricultural R&D, and gauges progress towards the doubling of agricultural productivity and the incomes of small-scale food producers by 2030, as set out in SDG target 2.3.

Among the high-income tier, Slovakia suffered the largest cut in government spending on agricultural R&D, plummeting by 83.7 points. Norway and Canada suffered drops of more than 20 points, while Bahrain, Finland and France all fell by around 17 points each. These drops are particularly concerning, as they were coupled with deteriorating performances in access to agricultural technology, education and resources. The GFSI shows that these high-income nations suffered greater volatility in production and greater food loss, even as their vulnerability to climate and natural resource risks grew. Going forward, governments should be looking to protect themselves from risks and investing in climate-proofing their agricultural sectors.

Food security policy and access commitments are key if the world is to transition to a more sustainable food system

Policymakers must put food security on the national agenda if the world is to transition away from an US$8trn global food system that experts say would be insolvent if it was a business where the polluter pays.[26] Its annual economic value would be overwhelmed by the hidden costs of its negative impacts, estimated to be US$12trn annually.[27] These costs include reduced human health, lost economic opportunity and environmental degradation.

Farmers must also be recognised as part of the solution and incentivised to implement climate-

26 Simon Zadek, Andreas Merkl, and Felipe Posada, "Making Finance Work for Food: Financing the Transition to a Sustainable Food System" (Finance for Biodiversity Initiative, September 2021), https://a1be08a4-d8fb-4c22-9e4a-2b2f4cb7e41d.filesusr.com/ug-d/643e85_58a8df7fe51e4076a64e2bbb38ed3a92.pdf.

27 "FoodSystems2030: Scaling up Action for Transformative Change" (World Bank, October 6, 2020), https://thedocs.worldbank.org/en/doc/183211604418620533-0090022020/original/BrochureFS20306Oct2020.pdf.

smart practices that sequester carbon in the soil. Discussions around COP26 and UN Food Systems Summit should result in a range of proposed new approaches and solutions to pressing environmental and food security challenges.

High-income countries that are better placed to drive positive change have fallen short when it comes to recognising the importance of driving food security in a sustainable manner. Setting up a national food security strategy would show that governments are making this a focus area and priority. However, only around half (19 of 36) of high-income countries have set up food security strategies, although this is higher than the 14% that had done so in 2012.

Setting up a dedicated agency would be a step further, allowing governments to take a co-ordinated approach, including investing in the right policies, programmes and incentives to boost food security and being held accountable for any targets set. However, only six wealthy countries have taken this step, up from two (Finland and Israel) in 2012, showing that there is a lot of room for improvement.

Chapter 3: What are the key actions that need to be taken to drive progress in food security in the next ten years and beyond?

The GFSI provides a wealth of data, gathered over ten years, to show which actions need to be taken to drive progress towards the SDG target of eliminating hunger by 2030, and to transform food systems so that they become sustainable.

This requires moving beyond just food security to establishing a sustainable food-system that delivers food security and nutrition while responding to changing (and expanding) consumer demand in such a way that the economic, social and environmental bases are not compromised.[28]

Key steps that need to be achieved on the road to meeting this global demand and the 2030 SDG hunger goal include:

- improving innovations, strategic investment, research and training to achieve the most effective transformation of the agriculture production system;

- creating an enabling environment for local, regional and global markets; and

- balancing a food system where production and consumption is happening at local, regional and global levels (markets and trade).

Improvements in food affordability go beyond improving country wealth

Economic shocks can impact countries of all income levels. Countries were deeply impacted by covid-19, regardless of wealth. Inflation can have a drastic impact on high-income countries like Argentina and low-income ones like Sudan and Haiti.

Even aside from the dramatic inflation being seen in some countries, food price inflation has been on the rise globally in recent years, including in high-income countries such as Canada, Israel, Saudi Arabia, Australia, Uruguay and the US. Food security is traditionally significantly better than elsewhere in such countries—but rising food costs could jeopardise this.

Countries should find ways to better prepare for shocks, such as through robust food safety nets. These safety nets will need to evolve to account for the rise of "black swan" events like covid-19. Well-funded, transparent and targeted support programmes operated by national governments are more likely to succeed. Countries also need to establish national food security strategies, outlining key goals and measuring progress against them over time.

---

28 Hanh Nguyen, "Sustainable Food Systems: Concept and Framework" (Food and Agriculture Organization of the United Nations, 2018), http://www.fao.org/3/ca2079en/CA2079EN.pdf.

In addition, enabling access to financing can give lifelines to farmers to survive shocks, helping to ensure that food remains affordable. Market-based safety nets can meet immediate needs, while funding of long-term investments can support sustainable economic growth. At least US$60bn in investment will be needed each year to meet growing demand for food (demand is set to increase by 70% by 2050). Most of this will need to come from the private sector. [29]

Additional investment is necessary, particularly public funding of R&D in agriculture

Additional investment, particularly public investment in research and innovation in agriculture, is necessary to address current and future food-system challenges. If governments are able to mitigate the high additional costs weighed on food production by the impacts of climate change (estimated at about US$40bn per year), as well as the cost of hunger on GDP, they will have more money to consider spending on inclusive, sustainable and resilient food systems, and to achieve zero hunger.

The GFSI highlights how public investment in agriculture has declined or not kept pace with growth in the sector over the past ten years The Agricultural Orientation Index has declined in 63 of 113 countries (56%). This means that in just over half of the countries in the index, either agriculture's contribution to GDP has increased faster than government investment, or government investment in agriculture has declined more than the contribution made to overall GDP by the agricultural sector.

Academia and the private sector can play an important role in financing and innovation

Public-sector support is essential. But there are also opportunities for the academic and private sectors to reverse increases in hunger and put the world back on track for achieving zero hunger. GFSI analysis shows that weak access to the market and agricultural financial services is closely tied to higher rates of hunger (and stunting in children). At the same time, central banks are undergoing a broad shift in thinking that acknowledges the need to take climate risks into account and set up

Public expenditure on agricultural R&D
GFSI average scores for 113 countries
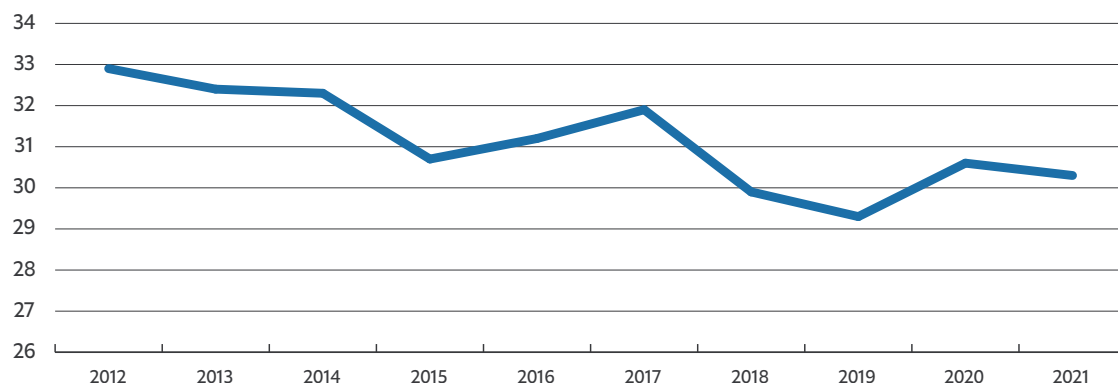
Source: The EIU, Global Food Security Index 2021.

29 "Agriculture Finance & Agriculture Insurance," World Bank, October 8, 2020, https://www.worldbank.org/en/topic/financialsector/brief/agriculture-finance.

regulations that govern how businesses report, beyond just financial measures. Experts are urging governments and key thought-leaders to apply what has been learned from the revolution in clean energy, where global finance is targeting a net-zero future through improved risk pricing and regulation, guidance from central banks, financial innovation, and shareholder and citizen action.[30]

Data and innovation too will play a part. The covid-19 pandemic has forced governments in emerging markets, including Africa, to use digital agriculture technologies to support emergency responses, using real-time data to assess the state of food security, particularly during lockdowns (for example, to better target cash transfers to farmers). This has encouraged more data sharing between the private and public sectors and opened up the potential to build a more systematic transformation of agri-food systems across the continent.

500m smallholder farming households—representing 2.5bn people—rely on agricultural production for their livelihoods, highlighting a need to focus on practical, locally applicable solutions.

This kind of innovation, technology and data use will play an increasing role in securing food, representing a particularly valuable toolkit, when considering studies showing that Africa could be two to three times more productive if it intensified its agricultural productivity.[31] At a food summit in Rome held in August 2021, participants agreed the current agri-food systems do not work for much of the world population—or indeed, for the

planet. Greater efficiency, and a sustained push for "scientific innovation and digital technologies" is needed, said the director-general of the FAO, Qu Dongyu, at the event.[32]

Furthermore, expanded use of basic agriculture technologies, such as hybrid seeds, has incredible potential to increase productivity incomes and sustainable farming practices of smallholder farmers in many countries. In Nigeria, for example, only 10% of smallholder farmers have adopted the use of hybrid seeds, despite the country being among those facing the highest levels of food insecurity, and facing significant maize production deficits each year. Adoption of improved technologies, access to capital and markets, and application of best practices could greatly improve farming in the country.

Food security will come through effective local activation in rural areas, especially in Africa, Asia and Latin America

It is clear from looking at GFSI data that the regions needing the most help are rural areas in Africa, Asia and Latin America, where smallholder farmers predominate, and both poverty and hunger are rife.

An estimated 500m smallholder farming households—representing 2.5bn people—rely on agricultural production for their livelihoods, highlighting a need to focus on practical, locally applicable solutions.[33] Therefore, while having national adaptation and food security plans is essential, these plans need to work at the local level.

While the focus needs to remain on these vulnerable regions, enabling actions are also

30 Zadek, Merkl, and Posada, "Making Finance Work for Food: Financing the Transition to a Sustainable Food System."

31 Lutz Goedde, Amandla Ooko-Ombaka, and Gillian Pais, "Winning in Africa's Agricultural Market" (McKinsey & Company, February 15, 2019), https://www.mckinsey.com/industries/agriculture/our-insights/winning-in-africas-agricultural-market.

32 "Funding, Scientific Innovation and Digital Technologies Vital to End Hunger - FAO," Sunday Observer, August 8, 2021, sec. Business, https://www.sundayobserver.lk/2021/08/08/business/funding-scientific-innovation-and-digital-technologies-vital-end-hunger-fao.

33 "Agriculture Finance & Agriculture Insurance."

required in developed nations such as the US and Denmark. Research from Feeding America, a US-based hunger-relief organisation, shows that of the 63% of counties in the US that are rural, 87% face relatively high rates of overall food insecurity.[34]

Ensuring adoption of healthy eating habits requires a more nuanced approach than improving overall food availability

Studies show that eating healthier foods is more expensive—healthy diets were out of reach for 3bn people—especially the poor, and spanning every region of the world—in 2019. Shifting to healthy diets that take sustainability into account may help to lower health and climate change costs by 2030, as the hidden costs of these diets are lower compared with those of current consumption patterns.[35]

High-scoring countries in the GFSI also have high rates of obesity, but there is a gap in global data, with the availability of nutrients not always revealing choices that are made, meaning a more nuanced approach is needed to improve overall food availability.

The threat of climate change and the need to protect natural resources cannot be ignored

Countries will need to move from ignoring climate change to actively protecting natural resources and building resilience to ensure food security. Having a climate-change strategy that covers agricultural adaptation and mitigation will be key to encouraging innovation and driving investment in sustainable agriculture systems. Investment will also need to shore up transport and supply-chain infrastructure, from the "first mile" right through to the consumer. This will need to happen for both wealthy countries and in vulnerable regions, to allow all to prepare for these environmental risks.

Case study: AI chases down locust plague in Africa

UN-backed PlantVillage embarked on one of the most innovative food security schemes over the past year when it deployed an artificial intelligence (AI) enabled app in smartphones across the Horn of Africa to empower farmers to collectively mitigate damage to crops by the largest swarms of locusts seen in the region for decades. The project prevented the destruction of more than US$1.5bn in agricultural products, with the FAO estimating that it preserved the livelihoods of 34m people. The eLocust3M app used AI, satellite technology and an on-the-ground field force in Kenya, Ethiopia and Somalia. Farmers who spotted the locusts uploaded photos to PlantVillage. Farmers in the surrounding villages were warned about the arrival of locusts and sent tips via smartphone, SMS, television or social networks to help track the locusts. An on-the-ground team scoured the regions on scooters, photographing the swarms and marking their GPS location. Satellite maps and other information were assessed with AI to predict where locusts would travel next, with the government sending out targeted teams with pesticide sprays. PlantVillage has also used drones to measure disease pressure in fields, used nanotechnology to diagnose infection in cassava plants and created the world's largest open-access library on crop health.[36]

34 Liz Carey, "Research: Food Insecurity Is Worse for Rural Residents During the Pandemic" (The Daily Yonder, November 5, 2020), http://dailyyonder.com/research-food-insecurity-is-worse-for-rural-residents-during-the-pandemic/2020/11/05/.

35 "Growing Better: Ten Critical Transitions to Transform Food and Land Use" (The Food and Land Use Coalition, September 2019), https://www.foodandlandusecoalition.org/wp-content/uploads/2019/09/FOLU-GrowingBetter-GlobalReport.pdf.

36 "About," PlantVillage, accessed October 1, 2021, https://plantvillage.psu.edu/.

Conclusion

The UN Secretary General has deemed this decade the "Decade of Action" to achieve the ambitious SDG target of achieving Zero Hunger by 2030. Although it is likely that this goal is out of reach, it is important to take stock as the world looks to transition to a sustainable food system. The GFSI shows that multiple, interlinked and mutually reinforcing drivers determine food security, requiring a coherent mix of policies, investments and regulations to accelerate progress. By documenting and analysing these drivers, the GFSI data show which steps need to be taken to achieve food security, and which gaps and shortfalls need to be urgently filled.

To this end, we outline some key steps that need to be taken within the framework of the UN's Zero Hunger Goal, as set out in SDG 2:

- Nations must ensure that comprehensive food safety-net programmes are in place, as well as lowering inequality in income and across genders, as this is strongly linked to lower rates of hunger and to ending malnutrition, especially stunting among children (**SDG goals 2.1 and 2.2**).

- Food safety nets have become imperative for governments to protect their most vulnerable at times of economic shock and amid crises like the covid-19 pandemic, as well as providing longer-term support for new productive activities. Attention must turn towards the funding of

these safety nets, as this indicator experienced the largest average decline in score across all countries. More and more countries are facing difficulties finding funds as more people turn to such programmes, and to chronic food aid, to access food.

- The drop in public spending in agricultural R&D over the past ten years, especially among the high-income tier, is a major obstacle to **SDG goal 2.3**, which aims for the doubling of agricultural productivity and the incomes of small-scale food producers by 2030.

- The fall in R&D spending comes amid greater volatility in production and greater food loss as the earth's sensitivity to climate risks grows. Governments must invest in future-proofing their food supply—for example, by researching how to boost yields on limited land with finite resources. This will need to be backed by the expertise, funding and resources of the private sector.

- Investment in R&D must go hand-in-hand with giving farmers access to agricultural technology, education and resources, yet our measure of this has stagnated over the past decade. Supporting farmers in this way is key to boosting productivity and incomes, as it will enable farmers and smallholders to access and adopt technology and best practices at the local level.

- Prioritising agricultural adaptation, including through national and regional policies, and disaster risk management plans, will help to achieve **goal 2.4**, which aims to enable sustainable food production systems and implement resilient agricultural practices. Nations have been on the back-foot when it comes to climate change, with their natural resources highly exposed, minimal efforts taken to protect nature and little being done in the way of resilience planning. This is all reflected in low scores for the Natural Resources and Resilience pillar of the GFSI over the past decade.

- But action is starting to happen—nearly half of the top-growing GFSI drivers over the past ten years relate to nations adopting adaptation and risk-management policies (alongside those linked to nutrition and food security). This type of governance will be essential to direct attention to the emergency at hand, mitigate the loss of grasslands, forests and resourceful land, and encourage innovation and investment in a climate-positive food system.

- Promoting access to the local, regional and global market and to financial services is key to achieving **SDG goals 2.A** (increase investments in developing countries to increase productivity) and **2.C** (adopt measures to ensure proper functioning of commodity markets and access to market information).

- The GFSI shows that access to markets and diversified financial products is closely linked to ending hunger, and growth in this sector was among the biggest gains in the GFSI in 2012-21. Diversified financial tools such as weather-based crop insurance and price-hedging instruments can enable farmers to survive economic and climate crises and continue operating their

business. Investing must be made in resilient infrastructure and food storage, digital solutions, and technology along the value chain, as these are key components of food security, particularly amid climate variability and extreme weather.

- At a broader economic level, central banks are moving to recognise climate risks in the operations of businesses.[37] Notably, the IMF has advocated for fiscal policies which would "price in externalities and provide [the business community with] incentives for the transition to a low-carbon economy".[38] This has the potential to reshape the agricultural sector, much like it did the clean-energy sector.

- Food security cannot exist without stability. Whether it be years of conflict as seen in Yemen, or the collapse of the market as seen in Venezuela—the most deteriorated food security environment in the GFSI over the past decade—governments need a holistic approach that focuses on promoting political and social stability; protecting vulnerable populations through safety nets; making food affordable by establishing strong market access and financial products; investing in boosting food supply through R&D and resilient infrastructure; and committing to food security, nutritional standards and adaptation amid growing climate risks.

---

37 Pierpaolo Grippa, Jochen Schmittmann, and Felix Suntheim, "Climate Change and Financial Risk," Finance & Development (International Monetary Fund, December 2019), https://www.imf.org/external/pubs/ft/fandd/2019/12/climate-change-central-banks-and-financial-risk-grippa.htm.

38 Ibid.

Appendix I: GFSI 2021 results

Table 1. 2021 GFSI overall rankings table

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

Rank / 113	Country	Score / 100
1	Ireland	84.0
2	Austria	81.3
3	United Kingdom	81.0
4	Finland	80.9
5	Switzerland	80.4
6	Netherlands	79.9
7	Canada	79.8
8	Japan	79.3
9	France	79.1
9	United States	79.1
11	Germany	78.7
12	Israel	78.0
13	Sweden	77.9
14	Czech Republic	77.8
15	Singapore	77.4
16	New Zealand	76.8
17	Denmark	76.5
18	Italy	76.4
19	Belgium	76.1
20	Norway	76
21	Portugal	75.2
22	Poland	74.9
23	Russia	74.8
24	Costa Rica	73.6
24	Qatar	73.6
24	Spain	73.6
27	Greece	73.3
28	Chile	73.2
29	Romania	72.4
30	Kuwait	72.2
31	Hungary	72.1
32	Australia	71.6
32	South Korea	71.6
34	China	71.3
35	United Arab Emirates	71.0
36	Belarus	70.9
36	Panama	70.9
38	Bulgaria	70.5

Rank / 113	Country	Score / 100
39	Malaysia	70.1
40	Oman	70.0
41	Kazakhstan	69.2
42	Slovakia	68.7
43	Bahrain	68.5
44	Saudi Arabia	68.1
45	Uruguay	68
46	Mexico	66.9
47	Dominican Republic	65.4
48	Turkey	65.1
49	Jordan	64.6
49	Peru	64.6
51	Thailand	64.5
52	Colombia	64.4
53	Argentina	64.2
54	Algeria	63.9
55	Tunisia	62.7
56	Azerbaijan	62.6
57	Morocco	62.5
58	Ukraine	62.0
59	Paraguay	61.6
60	Serbia	61.4
61	Vietnam	61.1
62	Egypt	60.8
63	Brazil	60.6
64	Philippines	60.0
65	Bolivia	59.9
66	Ecuador	59.6
67	El Salvador	59.5
68	Honduras	59.4
69	Indonesia	59.2
70	South Africa	57.8
71	India	57.2
72	Myanmar	56.7
73	Nicaragua	56.0
74	Botswana	55.5
75	Pakistan	54.7
76	Mali	54.5

Rank / 113	Country	Score / 100
77	Sri Lanka	54.1
78	Uzbekistan	53.8
79	Nepal	53.7
80	Guatemala	53.5
81	Cambodia	53.0
82	Ghana	52.0
83	Tajikistan	51.6
84	Bangladesh	49.1
85	Burkina Faso	48.1
86	Côte d'Ivoire	48.0
86	Tanzania	48.0
88	Niger	47.6
89	Senegal	47.4
90	Kenya	46.8
91	Laos	46.4
92	Cameroon	45.5
93	Benin	45.2
94	Togo	44.2
95	Uganda	43.9
96	Guinea	43.0
97	Nigeria	41.3
98	Angola	41.1
99	Chad	40.6
100	Madagascar	40.4
101	Rwanda	40.3
102	Venezuela	39.4
103	Congo (Dem. Rep.)	39.1
104	Sierra Leone	38.1
105	Zambia	38.0
106	Haiti	37.8
106	Syria	37.8
108	Ethiopia	37.6
109	Malawi	37.3
110	Sudan	37.1
111	Mozambique	35.9
112	Yemen	35.7
113	Burundi	34.7

Table 2. Score changes

(Net change in overall score, 2021 versus 2012)

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

Rank / 113	Country	Score / 100
86	Tanzania	+13.3
40	Oman	+11.9
54	Algeria	+10.7
34	China	+9.6
35	United Arab Emirates	+9.6
23	Russia	+9.4
81	Cambodia	+9.2
75	Pakistan	+9
90	Kenya	+8.5
59	Paraguay	+8.5
57	Morocco	+8.4
36	Panama	+8.4
96	Guinea	+8.3
76	Mali	+7.9
85	Burkina Faso	+7.7
41	Kazakhstan	+7.7
38	Bulgaria	+7.4
99	Chad	+7.4
24	Qatar	+7.4
83	Tajikistan	+7.4
88	Niger	+7.2
61	Vietnam	+7.2
64	Philippines	+7.1
79	Nepal	+7
36	Belarus	+6.9
72	Myanmar	+6.9
65	Bolivia	+6.8
103	Congo (Dem. Rep.)	+6.8
69	Indonesia	+6.7
29	Romania	+6.2
7	Canada	+6.1
3	United Kingdom	+6.1
89	Senegal	+6
45	Uruguay	+6
28	Chile	+5.4
12	Israel	+5.4
43	Bahrain	+5.3
93	Benin	+5.3

Rank / 113	Country	Score / 100
94	Togo	+5.2
56	Azerbaijan	+5.1
68	Honduras	+5.1
15	Singapore	+5.1
91	Laos	+4.9
49	Peru	+4.8
51	Thailand	+4.8
84	Bangladesh	+4.7
39	Malaysia	+4.6
60	Serbia	+4.6
44	Saudi Arabia	+4.5
22	Poland	+4.4
104	Sierra Leone	+4.3
86	Côte d'Ivoire	+4.2
58	Ukraine	+4.2
24	Costa Rica	+4.1
32	South Korea	+4.1
1	Ireland	+4
108	Ethiopia	+3.9
31	Hungary	+3.9
46	Mexico	+3.9
47	Dominican Republic	+3.7
100	Madagascar	+3.7
95	Uganda	+3.6
66	Ecuador	+3.3
30	Kuwait	+3.3
53	Argentina	+3.2
82	Ghana	+3.2
14	Czech Republic	+2.9
71	India	+2.7
55	Tunisia	+2.7
6	Netherlands	+2.4
110	Sudan	+2.4
27	Greece	+2.3
97	Nigeria	+2.3
8	Japan	+2.2
70	South Africa	+2
62	Egypt	+1.9

Rank / 113	Country	Score / 100
74	Botswana	+1.8
67	El Salvador	+1.8
2	Austria	+1.7
5	Switzerland	+1.5
16	New Zealand	+1.4
73	Nicaragua	+1.4
92	Cameroon	+1.3
9	United States	+1.3
52	Colombia	+1.2
80	Guatemala	+1.2
42	Slovakia	+1.2
11	Germany	+1.1
48	Turkey	+1.1
98	Angola	+1
77	Sri Lanka	+1
32	Australia	+0.7
13	Sweden	+0.6
78	Uzbekistan	+0.5
4	Finland	+0.3
19	Belgium	0
17	Denmark	0
9	France	0
18	Italy	0
112	Yemen	0
24	Spain	-0.2
105	Zambia	-0.2
49	Jordan	-0.4
106	Haiti	-0.9
21	Portugal	-1.5
111	Mozambique	-1.8
109	Malawi	-2.2
101	Rwanda	-3.3
20	Norway	-3.4
106	Syria	-3.4
113	Burundi	-4.5
63	Brazil	-4.8
102	Venezuela	-9.9

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 58 unique indicators that measure the drivers of food security across both developing and developed countries.

For the 2021 GFSI, the Economist Impact team reviewed all four categories— "Affordability", "Availability", "Quality and Safety", and "Natural Resources and Resilience"—to identify any need to add or remove sub-indicators or update the existing ones. The sub-indicator on storm severity was removed, as the dataset is no longer being updated.

Other changes in the 2021 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 2021 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 and Resilience**
4.1)	Exposure
4.1.1)	Temperature rise
4.1.2)	Drought
4.1.3)	Flooding
4.1.4)	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, Economist Impact has used estimates. Estimated figures have been noted in the model workbook. Of the qualitative indicators, some have been created by Economist Impact, 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 Economist Impact team.

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 Economist Impact 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 2021 index are:

Asia Pacific	Europe	Latin America	Middle East and North Africa	North America	Sub-Saharan Africa
Australia	Austria	Argentina	Algeria	Canada	Angola
Azerbaijan	Belarus	Bolivia	Bahrain	United States	Benin
Bangladesh	Belgium	Brazil	Egypt		Botswana
Cambodia	Bulgaria	Chile	Israel		Burkina Faso
China	Czech Republic	Colombia	Jordan		Burundi
India	Denmark	Costa Rica	Kuwait		Cameroon
Indonesia	Finland	Dominican Republic	Morocco		Chad
Japan	France	Ecuador	Oman		Congo (Dem. Rep.)
Kazakhstan	Germany	El Salvador	Qatar		Côte d'Ivoire
Laos	Greece	Guatemala	Saudi Arabia		Ethiopia
Malaysia	Hungary	Haiti	Syria		Ghana
Myanmar	Ireland	Honduras	Tunisia		Guinea
Nepal	Italy	Mexico	Turkey		Kenya
New Zealand	Netherlands	Nicaragua	United Arab Emirates		Madagascar
Pakistan	Norway	Panama	Yemen		Malawi
Philippines	Poland	Paraguay			Mali
Singapore	Portugal	Peru			Mozambique
South Korea	Romania	Uruguay			Niger
Sri Lanka	Russia	Venezuela			Nigeria
Tajikistan	Serbia				Rwanda
Thailand	Slovakia				Senegal
Uzbekistan	Spain				Sierra Leone
Vietnam	Sweden				South Africa
	Switzerland				Sudan
	Ukraine				Tanzania
	United Kingdom				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:

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

where Lower threshold (x) and Upper threshold (x) are 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:

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

where Lower threshold(x) and Upper threshold(x) are 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 2021 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 2012-21 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 2021 edition of the GFSI introduces a few 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 Economist Impact 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	UN Food and Agriculture Organisation (FAO)	A measure of the change in average monthly food costs (over a 12-month period), as captured through the Food CPI, which tracks changes in the price of the average basket of food goods since 2015.	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	UN Development Programme	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	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	Economist Impact calculation	A composite indicator assessing the presence and nature of food safety-net programmes. Sub-indicators include: • presence of food safety-net programmes; • coverage of food safety net programmes; and • funding for food safety-net programmes; • operation of food safety-net programmes.	
1.5.1	Presence of food safety-net programmes	Qualitative scoring by Economist Impact 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 Economist Impact 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 Economist Impact 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 Economist Impact 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.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
1.6	Market access and agricultural financial services	Economist Impact calculation	A composite indicator measuring the market access and agricultural financial services. Sub-indicators 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 Economist Impact 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 Economist Impact 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.
1.6.3	Access to market data and mobile banking	International Telecommunication Union	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	Economist Impact calculation	A composite indicator that measures the availability of food. It comprises the following sub-indicators: • 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 the change in emergency food aid per capita received over the past five years.	Consistent, high levels of food aid indicate that the available food supply is insufficient to meet the population needs.
2.2	Agricultural research and development	Economist Impact calculation	A composite indicator that measures agricultural research and development. It comprises the following sub-indicators: • 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.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
2.2.2	Access to agricultural technology, education and resources	US Department of Agriculture (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 versus 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 versus available calories).
2.3	Agricultural infrastructure	Economist Impact calculation	A composite indicator that measures ability to store crops and transport them to market. Sub-indicators include: • crop storage facilities; • road infrastructure; • air, port and rail infrastructure; and • irrigation infrastructure.	
2.3.1	Crop storage facilities	Qualitative scoring by Economist Impact 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	Economist Intelligence Risk Briefing	An assessment of the quality of road infrastructure, measured on a 0-4 scale, where 4 = best.	Regardless of a country's geography and infrastructure, road infrastructure plays a crucial role in food transport.
2.3.3	Air, port and rail infrastructure	Economist Intelligence Risk Briefing	An assessment of the quality of air, port and rail infrastructure, measured on a 0-4 scale, where 4 = best.	Depending on a 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 five-year period for which data are available.	Fluctuations in agricultural productivity can create difficulty in predicting and planning for a consistent food supply.
2.5	Political and social barriers to access	Economist Impact calculation	A composite indicator that measures political and social barriers to access. Sub-indicators include: • armed conflict; • political stability risk; • corruption; and • gender inequality.	
2.5.1	Armed conflict	Economist Intelligence 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	Economist Intelligence 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	Economist Intelligence 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.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
2.5.4	Gender inequality	UN Development Programme	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 overall food availability.
2.7	Food security and access policy commitments	Economist Impact calculation	A composite indicator that measures food security and access policy commitments. Sub-indicators include: • food security strategy; and • food security agency.	
2.7.1	Food security strategy	Qualitative scoring by Economist Impact 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 Economist Impact 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

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
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	Economist Impact calculation	A composite indicator that measures government commitment to increasing nutritional standards. It comprises the following binary sub-indicators: • national dietary guidelines; • national nutrition plan or strategy; and • nutrition monitoring and surveillance.	
3.2.1	National dietary guidelines	Economist Impact scoring	An assessment of whether the government has published guidelines and has conducted educational campaigns 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 Economist Impact 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.
3.2.3	Nutrition labelling	Qualitative scoring by Economist Impact 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 helps consumers to better understand the caloric and nutritional value of purchased foods.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
3.2.4	Nutrition monitoring and surveillance	Qualitative scoring by Economist Impact 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	Economist Impact calculation	A composite indicator that measures the availability of micronutrients in the food supply. Sub-indicators 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	Economist Impact calculation based on data from FAO, WHO and 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	Economist Impact calculation	A composite indicator that measures the enabling environment for food safety. The sub-indicators 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.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
4) Natural Resources and Resilience				
4.1	Exposure	Economist Impact calculation	A composite indicator that measures exposure to the impacts of climate change. Sub-indicators include: • temperature rise; • drought; • flooding; • storm severity (AAL); and • sea level rise.	
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	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 five consecutive days.	Susceptibility to flooding can lead to unpredictable crop loss and declines in food supply in certain years.
4.1.4	Sea level rise	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	Economist Impact calculation	A composite indicator that measures the health of fresh-water resources and how depletion might impact agriculture. Sub-indicators 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	Economist Impact calculation	A composite indicator that measures the health of land, and how land degradation might impact agriculture. Sub-indicators 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.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
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 CO2, 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	Economist Impact calculation	A composite indicator that measures the health of oceans, a crucial source of protein for many populations. Sub-indicators include: • eutrophication; and • marine biodiversity.	
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	Economist Impact calculation	A composite indicator that measures how susceptible countries are to the depletion of natural resources and agricultural productivity. Sub-indicators 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	Economist Impact 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. Sub-indicators include: • early warning measures/climate-smart agriculture; • commitment to managing exposure; • national agricultural adaptation policy; and • disaster risk management.	

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
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	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 Economist Impact 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, Economist Impact has undertaken qualitative research. Where information is not publicly available, Economist Impact 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.
4.7	Demographic stress	Economist Impact 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. Sub-indicators 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; Economist Impact	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 five-year growth in GDP per capita minus five-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.

While every effort has been taken to verify the accuracy of this information, Economist Impact cannot accept any responsibility or liability for reliance by any person on this report or any of the information, opinions or conclusions set out in this report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor.

ECONOMIST IMPACT