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# Global Food Security Index **2022**

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# Preface

The Global Food Security Index (GFSI) is the pre-eminent 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: affordability, availability, quality and safety, and sustainability and adaptation. The index is based on a dynamic benchmarking model constructed from 68 qualitative and quantitative drivers of food security.

This report is a compilation of 11 years of research conducted by Economist Impact between 2012 and 2022. 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 2022 model and the global research report are available online at <http://economistimpact.com/food-security-index>. Please visit the website for more information on the global rankings, key findings and 2022 methodology.

The project management team (Kathleen Harrington, Sardar Karim, Apurva Kothari, Eve Labalme, Bhagya Raj Rathod, Aayushi Sharma and Pratima Singh) would like to extend our thanks to the experts, researchers, writer (Marianne Bray), editor (Paul Tucker) and graphic designer (Michael Kenny) who lent their expertise to this project.

# Executive summary

At a time when global food security is of utmost importance, the Global Food Security Index (GFSI) shows that the global food environment is deteriorating. After hitting its peak in 2019, the GFSI has since declined amid skyrocketing food prices and hunger on an unprecedented scale.

Based on 11 years of data, the index highlights that the food system has been weakening over the years, with shocks in 2020-22, including the covid-19 pandemic and high commodity prices, showcasing this fragility. These shocks exacerbate the systemic issues that are threatening food security and weakening the resilience of the food system.

The downward trend in food security is a reversal from the GFSI's early days, which saw eight years of strong growth before a slowdown began. This subsequent stalled progress reflects structural issues and significant risks in the global food system, which include, but are not limited to, volatility in agricultural production, scarcity of natural resources, increasing economic inequality, and trade and supply-chain volatility. The economic and socio-political shocks of the past few years have only exacerbated an already-weakening food environment. As these shocks become more frequent and severe, global food security will be increasingly threatened.

## Overall food security environment: the top- and bottom-ranking countries in 2022

Best performers	2022 score	Weakest performers	2022 score
Finland	83.7	Syria	36.3
Ireland	81.7	Haiti	38.5
Norway	80.5	Yemen	40.1
France	80.2	Sierra Leone	40.5
Netherlands	80.1	Madagascar	40.6
Japan	79.5	Burundi	40.6
Canada	79.1	Nigeria	42
Sweden	79.1	Venezuela	42.6
United Kingdom	78.8	Sudan	42.8
Portugal	78.7	Congo (Dem. Rep.)	43

In GFSI 2022, affordability drags the index down. The index's affordability score has fallen by 4%, from 71.9 to 69, between 2019 and 2022 as shocks like the covid-19 pandemic and the war on Ukraine have led to rising costs for food. In addition, weakening trade freedom and an inability to fund safety nets have made it harder for people to afford food around the world.

Meanwhile, social and political barriers to access have dampened the availability of food. In the past three years, the GFSI has shown rising risks from armed conflicts and political instability, indicators which have seen scores fall by 4% and 6% respectively. This has been accompanied by a growing dependency on chronic food aid, the score for which has dropped by 8% since 2019.

However, new metrics incorporated in this year's GFSI model, including new metrics to gauge the inputs that farmers use on their farms and in the "first mile" (the segment that links farmers to the nearest market), show that agricultural inputs have seen some of the biggest increases in GFSI scores in the past few years (albeit, from a very low base, as these are some of the lowest-scoring indicators in the index). For example, scores measuring commitments to empowering female farmers and food security strategies have increased by 19% and 13% respectively. In addition, despite a 10% fall in

public expenditure on research and development since the index's inception in 2012, there has been a strong reorientation towards innovation, with big improvements in access to agricultural technology, education and resources, and in commitments to using innovative technology. The growth in the use of these inputs is crucial in improving agricultural productivity and enhancing food security (these measures have proven critical in staunching further declines in the GFSI in 2022).

Also key in halting the index's slide in 2022 are big jumps in political commitments to agricultural adaptation and sustainability, especially related to financing. On average, scores for political commitments to adaptation increased by 10% from 2019 to 2022. In 2022 89 countries have a current climate strategy in place with specific measures for agriculture or food security, compared to just 74 countries in 2019. Improvements in political commitments to adaptation also include score increases in environmental economic accounting, risk management coordination and climate finance flows as central banks around the world push for green finance. There are also big jumps in scores for pest infestation and disease mitigation policies and a smaller jump in commitments to sustainable agriculture practices. In contrast, the GFSI also highlights how poorly nations fare in their soil organic content, which is important for growing high-nutrient foods, and in irrigation infrastructure, which is particularly important to have in place as the climate warms.

Eight of the top ten performers in 2022 come from high-income Europe, led by Finland (with a score of 83.7), Ireland (scoring 81.7) and Norway (scoring 80.5). These nations score strongly on all four pillars of the GFSI. Japan (scoring 79.5) and Canada (scoring 79.1) round out the remainder of the top ten. (See table on p. 4)

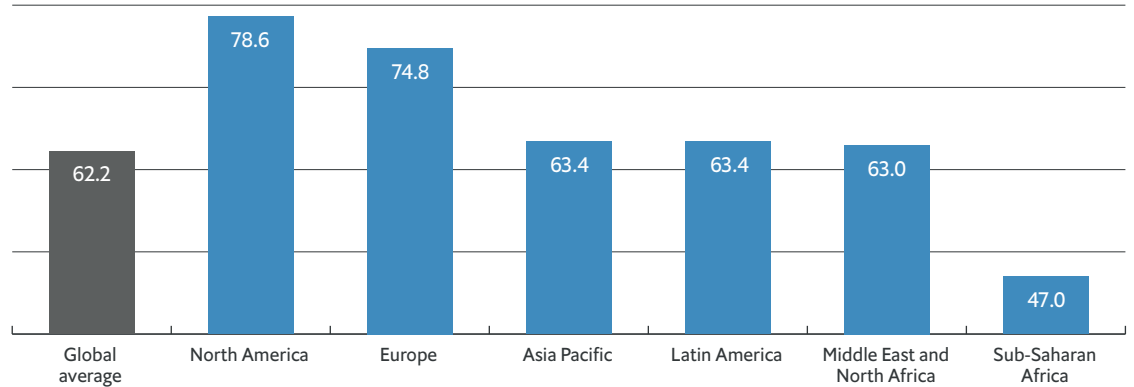
**Between 2019 and 2022, the index's affordability score has fallen by 4%, from 71.9 to 69, as shocks like the covid-19 pandemic, high input costs, and the war on Ukraine have led to rising costs for food.**

Consistent with previous years of the index, six of the bottom ten scoring nations in 2022 come from Sub-Saharan Africa. The Middle East and North Africa, along with Latin America, are home to the three worst performing nations. Syria sits at the bottom of the list (with a score of 36.3), followed by Haiti (scoring 38.5) and Yemen (scoring 40.1). The

gap between the best performing country and the worst performer is stark—Syria scores less than half the score of Finland. The difference between the top performer and the country at the bottom of the ranking has continued widening since 2019, reflecting the inequity in the global food system.

### Overall GFSI 2022 scores, by region

*In 2022, besides Sub-Saharan Africa, all regions performed above the global average, with North America leading the index.*



Source: Global Food Security Index 2022.

# Chapter 1

## Driven by long-term systemic issues, weakness in the global food security environment continues

The 2022 Global Food Security Index (GFSI) shows that the overall food security environment continues to deteriorate for the 113 nations in the index. The early years of the GFSI (2012-15) saw the biggest improvements, with the average overall food security environment score jumping by 6%. However, the GFSI saw slower growth between 2015 and 2019 and then has weakened from 2019 to 2022, plateauing over the past three years as the world faces its highest-ever food prices and hunger on an unprecedented scale.<sup>1</sup> The GFSI score topped 62.6 out of a possible 100 in 2019 but currently stands at 62.2. In 2022 the index was dragged down by falls in two of its strongest pillars—affordability, and food quality and safety—and saw continued weakness in its other two pillars—availability, and sustainability and adaptation.

In this report, the theme of resilience will be examined as it plays into each of the four pillars of the GFSI: economic resilience (affordability), production and agricultural resilience (availability), nutritional resilience (quality and safety), and environmental resilience (sustainability and adaptation). This report will examine this data to see what works best, especially when it comes to helping stakeholders to navigate an increasingly volatile world.

Affordability is a key component of food security. Whenever safe and nutritious food is not available at a price affordable to all, it jeopardises people's welfare. Affordability, the top-scoring pillar of the GFSI, dropped by 4% in 2019-22, from 71.9 to 69.0, dragged down by sharp rises in food costs, declining trade freedom and decreased funding for food safety nets.<sup>2</sup> Meanwhile, big falls in nutritional standards, particularly in national nutrition plans and monitoring, triggered a drop in scores, from 67.1 to 65.9, for the quality and safety pillar. Countries from all regions have dropped the ball on nutritional plans in 2022. Around one-third of countries (35 out of 113) have no national nutrition plan or strategy in 2022, nearly double the number that lacked one in 2019. In addition, 25 of 113 countries are not regularly monitoring the nutritional status of their population (compared with 15 in 2019). Without regular monitoring, policymakers cannot identify nutritional deficiencies and deploy resources where needed.

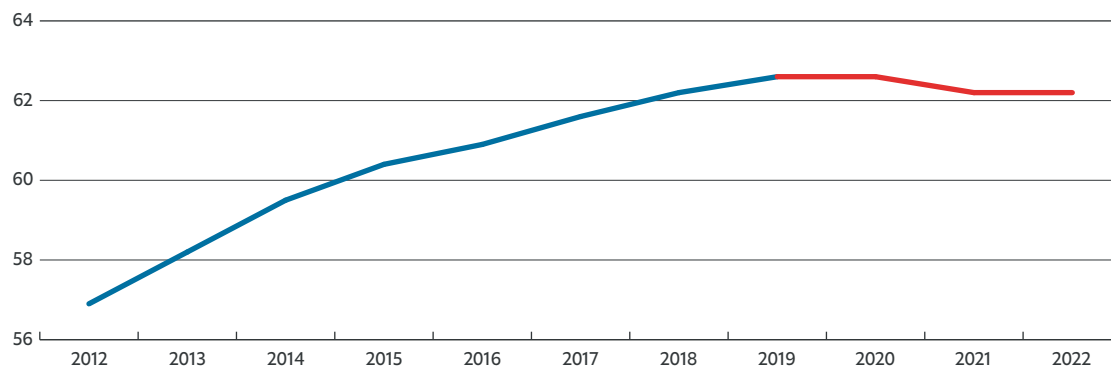
Concurrently, the index's remaining two pillars—availability, and sustainability and adaptation—remain weak. To boost availability, farmers need inputs like finance, but also community support, extension services and strong infrastructure, both on the farm and in supply chains. In 2022 the score for the availability pillar is only 57.8, while

1 "2022 global report on food crises." Global Network against Food Crises and Food Security Information Network. 2022. <https://www.wfp.org/publications/global-report-food-crises-2022>.

2 Food costs refers to indicator 1.1, "Change in average food costs from the GFSI". For more details and the complete framework, please refer to Appendix II.

## GFSI average overall score, global 2012-22

After climbing year on year between 2012 to 2018, the overall food security score has not improved since 2019.



Source: Global Food Security Index 2022.

sustainability and adaptation trail behind at 54.1. Farmers need political and social support to access markets and infrastructure, but the 2022 index shows that armed conflicts and political instability are being accompanied by a growing dependency on chronic food aid. Moreover, political upheaval and worsening climate change threaten to pull these pillars down further.

This weakening of the index's overall food security score comes as the world is experiencing an unprecedented level of global shocks.<sup>3</sup> These shocks are placing great pressure on food security with the UN World Food Programme (WFP) seeing the highest number of people in crisis (or worse) since it started releasing its food crisis reports six years ago.<sup>4,5</sup> Already, 811m people face hunger, and in 2020 one in three global citizens did not have

access to adequate food.<sup>6</sup> Experts say that shocks such as pandemics, conflict and extreme weather events due to climate change are going to become the new norm in a global food system of 600m food producers and 8bn consumers living in a degrading environment.<sup>7,8</sup>

Even before the impacts of these unpredictable, recent shocks were being felt, longer-term stresses were adversely affecting the global food system, both directly and indirectly. The most advanced countries were not immune to these structural risks in the global food system, which include volatility in agricultural production, scarcity of natural resources, and trade and supply-chain volatility. Looking ahead, most respondents to a recent World Economic Forum survey on global risks ranked "climate action failure" as both the top

3 "How can we protect food systems against global shocks? Here's what business leaders say." World Economic Forum. May 2022. <https://www.weforum.org/agenda/2022/05/protect-food-systems-against-global-shocks/>.

4 "2022 global report on food crises." Global Network against Food Crises and Food Security Information Network. 2022. <https://www.wfp.org/publications/global-report-food-crises-2022>

5 The Integrated Food Security Phase Classification (IPC) and the Cadre Harmonisé (CH) together make up the IPC/CH ranking. They gather data on food insecurity and malnutrition and the responses needed. The IPC/CH ranking has a five-phase categorisation, with crisis being phase 3. If households fall into this category, they either have food consumption gaps that are reflected by high or above-usual acute malnutrition, or they are marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies. Under this phase, urgent action is required to protect livelihoods and reduce food consumption gaps. Phase 4 and 5 are considered worse than crisis mode, with phase 4 being emergency and phase 5 catastrophe or famine, requiring increasingly urgent actions to address.

6 "The world is at a critical juncture." UN Food and Agriculture Organisation. 2021. [https://www.fao.org/state-of-food-security-nutrition#:~:text=Nearly%20one%20in%20three%20people%20in%20the%20world%20\(2.37%20billion,people%20in%20just%20one%20year](https://www.fao.org/state-of-food-security-nutrition#:~:text=Nearly%20one%20in%20three%20people%20in%20the%20world%20(2.37%20billion,people%20in%20just%20one%20year)

7 "How can we protect food systems against global shocks? Here's what business leaders say." World Economic Forum. May 2022. <https://www.weforum.org/agenda/2022/05/protect-food-systems-against-global-shocks/>

8 "Why is the world facing a food crisis?" World Bank. June 2022. <https://www.worldbank.org/en/news/podcast/2022/06/10/world-food-crisis-security-hunger-supply-chains-war-ukraine-development-podcast>.



long-term threat to the world and the risk that had the potential for the most severe impacts over the next decade, with a disorderly climate transition exacerbating inequalities.<sup>9</sup>

To counter these stresses and shocks, and to ensure food security in the future, stakeholders will need to adopt a systemic approach and build resilience in the supply of food and in the environment upon which food is grown and distributed. Looking at the effects of covid-19 on the food supply system, the longer-term issues highlighted by the pandemic—such as the limitations of cost-efficient and streamlined supply chains and lack of agility in redistributing supplies between parts of the food sector—will have to be addressed to build resilience to future shocks.<sup>10</sup>

To be resilient, a food system needs to deliver desired outcomes, even when exposed to these stresses and shocks.<sup>11</sup> Research shows that a resilient food system is robust (resists disruptions), is able to recover quickly after any disruption (bounces back) and re-orientates (bounces forward) towards more sustainable food system outcomes.<sup>12</sup>

All of these responses involve reorganising and adapting to the way that the food system operates. However, given the complexity and connectedness of the food system, multiple stakeholders need to work together to overcome the different food system stressors and shocks, and to define resilience collectively.

Particularly important will be to economically, socially and environmentally align the long-term drivers of food security with the goals of a sustainable food system—one that lies at the heart of the UN Sustainable Development Goals (SDGs).<sup>13</sup> Although sustainability and resilience are not the same, their twin aims can be positively synergistic if stakeholders focus on re-orientating. This puts the onus on introducing tools and policies that will counter shocks and risks in a net-zero and nature-positive way (that is, one that enriches biodiversity and protects the environment).<sup>14</sup> The focus should be on policies that take into account the impact on all sectors of the food system (and beyond), and can re-orientate to alternative food system outcomes.

So far, countries have been forced to react to shocks, but increasingly they will need to focus on long-term, sustainable solutions by prioritising agricultural adaptation practices. This has already started, as shown in the 2022 GFSI: despite the plateauing of overall scores since 2019, the sustainability and adaptation pillar has jumped by 3.8%, led higher by increasing political commitments to adaptation, national agricultural adaptation policies and disaster risk management, and a rise in environmental economic accounting. This adaptation is key: experts say that the sector needs to transform how it grows, distributes and

**Despite the plateauing of overall scores since 2019, the sustainability and adaptation pillar has jumped by 3.8%, led higher by increasing political commitments to adaptation, national agricultural adaptation policies and disaster risk management, and a rise in environmental economic accounting.**

9 "The global risks report 2022." World Economic Forum. 2022. [https://www3.weforum.org/docs/WEF\\_The\\_Global\\_Risks\\_Report\\_2022.pdf](https://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2022.pdf)

10 "Effects of COVID-19 on the food supply system." UK Parliament POST. July 2020. <https://post.parliament.uk/effects-of-covid-19-on-the-food-supply-system/#:~:text=In%20POST's%20survey%20of%20over,rationing%20or%20rules%20against%20stockpiling>

11 "Resilience of the UK Food System in a Global Context." Global Food Security programme. Accessed August 2022. <https://www.foodsecurity.ac.uk/research/food-system-resilience/>

12 Ibid.

13 "Sustainable food systems. Concept and framework." UN Food and Agriculture Association. 2018. <https://www.fao.org/3/ca2079en/CA2079EN.pdf>.

14 "What is 'nature positive' and why is it the key to our future?" World Economic Forum. June 2021. <https://www.weforum.org/agenda/2021/06/what-is-nature-positive-and-why-is-it-the-key-to-our-future/>

markets food; how it reorganises its social, policy, market, science and technology and biophysical environments; and how it looks at food system outcomes.

To examine the complexity of the food system and account for the importance of on-the-farm inputs and the “first mile” (the initial segment of our food sourcing) in achieving food security, several new indicators have been added to the GFSI this year, capturing data such as farmers’ access to community organisations and extension services, and changes in producers’ prices (see box 1). With a

more targeted focus on farmers, who are essential stakeholders in ensuring resilience in the food system, the GFSI will continue to help countries tailor policies and solutions to enhance global food security and counter growing shocks and risks to the system.

Although nations cannot totally eliminate these shocks and risks, they can adapt to them and mitigate their impacts by building resilience. Adaptation may well provide the best opportunity to build resilience, because it allows stakeholders to work within the existing situation.

### BOX 1: Changes to GFSI framework

In early 2022 Economist Impact consulted with an expert panel for the GFSI, resulting in 14 new indicators, leading to a final tally of 68. Although we have added new indicators at a broader level to reflect the global nature of the food system—for example, adding a measure on trade freedom—many of the new indicators highlight the importance of farmers. A key focus is on the farm and the “first mile”, the segment of agriculture that links farmers to the nearest market, allowing them to operate efficiently and profitably to sell the goods that they produce. Some of the new measures reflect the support available to farmers, including their access to extension services as well as community organisations like co-operatives, and whether female farmers are empowered.

There are other important changes to the organisation of the index. The GFSI’s second pillar, availability, has been adjusted to start at food production, capturing more farmer-focused measures on accessibility to agricultural inputs. This includes moving access to finance and financial products from the affordability pillar to the availability pillar, as these measures are farmer-related. Government commitment

to innovative technologies and a new composite indicator for on-farm infrastructure have also been added to this pillar to reflect more accurately what is happening on the fields in addition to in the supply chain.

Reflecting a global impetus to move to sustainable food systems and adapt to growing climate shocks, the GFSI’s fourth pillar, previously called “natural resources and resilience”, has been renamed “sustainability and adaptation”. Given how important biodiversity is to the agricultural sector, soil organic content has been added to help measure the health of the land and assess land degradation, while climate finance flows, environmental economic accounting implementation and sustainable agriculture have been added as new indicators to measure political commitment to adaptation more comprehensively. A new measure of pest infestation and disease has been added to the new composite indicator of disaster risk management as a way of including mitigation policies.

For more details and the complete 2022 GFSI framework, please refer to Appendix II.

# Chapter 2

## Shocks are more frequent and extensive, further weakening an already-fragile global food system

The shocks of 2020 through to 2022 have showcased the fragility of the global food system and its consequences, bringing food security concerns to the fore. These more frequent and extensive shocks—including covid-19, conflict, extreme weather events and soaring costs—are exacerbating the systemic issues that drive food security downward over time, weakening the resilience of the system.<sup>15</sup>

Even before Russia's invasion of Ukraine, state-based conflict had never been more prevalent, says the Oslo-based Peace Research Institute, and the number of conflicts continues to rise.<sup>16 17</sup> The picture is not much rosier for shocks associated with a changing climate. A 2019 report by the UN Food and Agriculture Organisation (FAO) said that the number of shocks such as drought and flooding rose significantly in the 21st century.<sup>18</sup> Indeed, whereas climate-induced shocks to the food system used to happen once every 12 years on average, they are now occurring about every 2.5 years.<sup>19</sup>

The confluence of these shocks, along with their increased recurrence, is pushing a fragile food system into tipping points more and more frequently, leaving more people hungry and sending food prices to levels not seen before.<sup>20</sup> The FAO food price index, which tracks the monthly change in international food prices, hit an all-time high in March 2022, and while it edged down in May it was still 22% above the value recorded a year earlier.<sup>21 22</sup>

These shocks are coming at a time when developing countries are already struggling with “cascading challenges” that the WFP says are not of their making, such as the COVID-19 pandemic and inadequate resources amid persistent and growing inequalities.<sup>23</sup> These inequalities are reflected in figures that show that while farmers are the stewards of half of the land on Earth and produce 95% of food, they also comprise 65% of the world's poorest people.<sup>24</sup>

15 “How can we protect food systems against global shocks? Here's what business leaders say.” World Economic Forum. May 2022. <https://www.weforum.org/agenda/2022/05/protect-food-systems-against-global-shocks/>.

16 “Conflict Trends: A Global Overview, 1946–2019.” Prio. 2020. <https://www.prio.org/publications/12442>.

17 Ibid.

18 “The state of the world's biodiversity for food and agriculture.” UN Food and Agriculture Organisation. 2019. <https://www.fao.org/3/CA3129EN/CA3129EN.pdf>.

19 Kray H, Shetty S, Colleye P. “Three challenges and three opportunities for food security in Eastern and Southern Africa.” World Bank. 2022. <https://blogs.worldbank.org/african/three-challenges-and-three-opportunities-food-security-eastern-and-southern-africa>.

20 “Why is the world facing a food crisis?” World Bank. June 2022. <https://www.worldbank.org/en/news/podcast/2022/06/10/world-food-crisis-security-hunger-supply-chains-war-ukraine-development-podcast>.

21 “FAO Food Price Index.” UN food and Agriculture Organisation. Accessed August 2022. <https://www.fao.org/worldfoodsituation/foodpricesindex/en/>

22 Ibid.

23 “2022 global report on food crises.” Global Network against Food Crises and Food Security Information Network. 2022. <https://www.wfp.org/publications/global-report-food-crises-2022>

24 “Transforming Food Systems with Farmers: A Pathway for the EU.” World Economic Forum. April 2022. [https://www3.weforum.org/docs/WEF\\_Transforming\\_Food\\_Systems\\_with\\_Farmers\\_A\\_Pathway\\_for\\_the\\_EU\\_2022.pdf](https://www3.weforum.org/docs/WEF_Transforming_Food_Systems_with_Farmers_A_Pathway_for_the_EU_2022.pdf)

## Conflict

Conflict is one of the main drivers of food insecurity, as evidenced in the GFSI, which shows that armed conflict is strongly linked to lower food security scores. Conflict negatively affects almost every aspect of the food system, from production, harvesting, processing and transport to input supply, financing, marketing and consumption.<sup>25</sup> The GFSI shows that armed conflict most negatively impacts supply-chain infrastructure, which is key to moving food from farm to fork.

113 nations were already at high or very high risk of conflict. Indeed a 2022 WFP report said that the war in Ukraine is “supercharging a three-dimensional crisis—food, energy and finance—with devastating impacts on the world’s most vulnerable people, countries and economies.”<sup>26</sup>

Conflict is also closely connected to climate change. Of the 25 nations most vulnerable to climate change, 14 are mired in conflict.<sup>27</sup> The ability of these countries to adapt to climate change is weakened when more urgent short-term issues such as safety and daily access to food are at stake and authorities and institutions are preoccupied with security.<sup>28</sup>

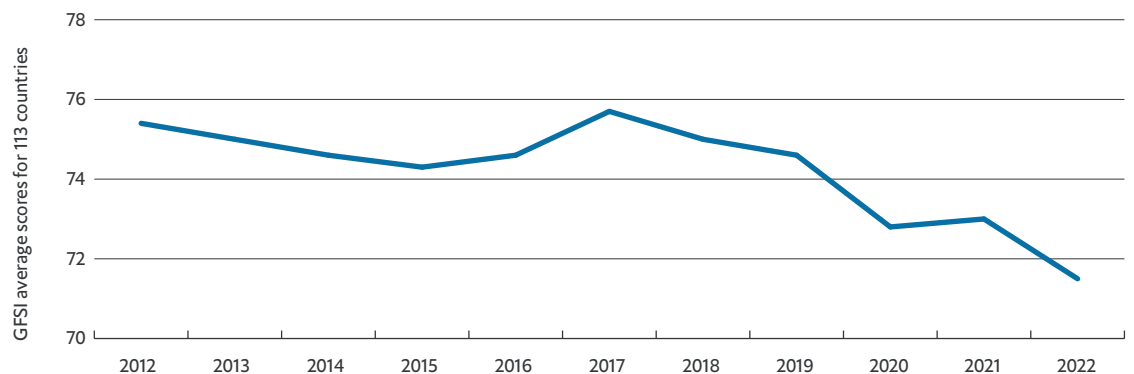
The natural environment can also be a casualty of conflict if it is attacked or damaged by warfare, leading to water, soil or land contamination, or air pollution.<sup>29</sup> Those living in conflict areas are more vulnerable to food insecurity. The GFSI shows a link between armed conflict and water pollution, with conflict impacting the quality and availability of this key resource for agriculture.

**The GFSI shows a link between armed conflict and water pollution, with conflict impacting the quality and availability of this key resource for agriculture.**

Hunger and food insecurity were already concentrated in conflict zones even before the Ukraine invasion. The GFSI shows that 17 out of

### Risk of armed conflict, 2012-22

*The global risk of armed conflict has increased since 2012.*  
(Lower score=higher risk)



Source: Global Food Security Index 2022.

<sup>25</sup> “The State of Food Security and Nutrition in the World 2021.” FAO, IFAD, UNICEF, WFP and WHO. 2021. <https://doi.org/10.4060/cb4474en>

<sup>26</sup> “2022 global report on food crises.” Global Network against Food Crises and Food Security Information Network. 2022. <https://www.wfp.org/publications/global-report-food-crises-2022>

<sup>27</sup> “Seven things you need to know about climate change and conflict.” International Committee of the Red Cross. July 2020. <https://www.icrc.org/en/document/climate-change-and-conflict#:~:text=Conflict%20can%20also%20contribute%20to,greenhouse%20gases%20into%20the%20air.>

<sup>28</sup> Ibid.

<sup>29</sup> Ibid.

## Cost

Food price shocks are both an effect and a determinant of conflict.<sup>30</sup> Robust demand, spurred by a recovery from covid-19 contractions, was pushing up food prices even before Russia's invasion of Ukraine, but the war has pushed prices even higher with the added pressure of supply constraints.<sup>31</sup> The 2022 GFSI data show that armed conflict has had a negative effect on affordability. The costs of energy, fertiliser and commodity prices have surged since the Ukraine conflict started, triggering price increases of up to 30% for staple foods.<sup>33</sup> Some areas in the US are reporting 300% increases in fertiliser costs.<sup>34</sup>

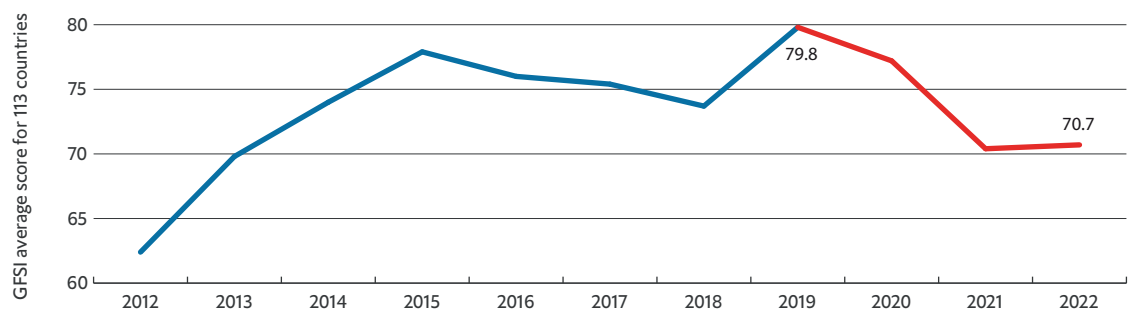
Higher prices for agricultural inputs such as fertiliser and fuel are being felt on the global markets through higher transport costs, logistical hurdles and disruption of supply chains, with the GFSI showing armed conflict has had a particularly

harmful effect on supply chain infrastructure.<sup>35</sup> Systemic issues in the food system, including excessive commodity speculation, have also contributed to record prices.<sup>36</sup> The 2022 GFSI data shows that the affordability of food has declined by 4% relative to 2019. GFSI scores measuring average food costs are poor—performance has plummeted by 11.4%, indicating soaring food prices between 2019 and 2022.

The world is now facing the third global food price crisis in 15 years and policymakers are keen to avoid a repeat of 2008, when food prices also reached record highs.<sup>37</sup> But they face a daunting task. "Climate change, widespread poverty and conflicts are now combining to create 'endemic and widespread' risks to global food security," the International Panel of Experts on Sustainable Food Systems has noted, "which means higher food prices may be the new normal unless action is taken to curb the threats."<sup>39</sup>

## Change in global average food costs, 2012-22

Between 2019 and 2022, the GFSI score for change in average food costs plummeted by 11.4%. (Lower score = higher average food costs)



Source: Global Food Security Index 2022.

30 "Do high food prices and droughts fuel conflict? Highlights from chapter 7 of the 2014-2015 Global Food Policy Report." International Food Policy Research Institute. March 2015. <https://www.ifpri.org/blog/do-high-food-prices-and-droughts-fuel-conflict#:~:text=Food%20price%20shocks%20are%20both,consequence%2C%20food%20and%20nutrition%20insecurity.>

31 "A Global Food Import Financing Facility (FIFF): Responding to soaring food import costs and addressing the needs of the most exposed." UN Food and Agriculture Organisation. June 2022. <https://www.fao.org/3/cb9444en/cb9444en.pdf>.

32 "FAO Food Price Index." UN food and Agriculture Organisation. Accessed August 2022. <https://www.fao.org/worldfoodsituation/foodpricesindex/en/>.

33 "Food insecurity threatens societies, exacerbates conflicts and 'no country is immune.'" UN News. May 2022. <https://news.un.org/en/story/2022/05/1118652>.

34 "Too Many to Count: Factors Driving Fertilizer Prices Higher and Higher." American Farm Bureau Federation. December 2021. <https://www.fb.org/market-intel/too-many-to-count-factors-driving-fertilizer-prices-higher-and-higher>.

35 Food security update. World Bank. August 2022. <https://www.worldbank.org/en/topic/agriculture/brief/food-security-up-date#:~:text=Globally%2C%20hunger%20levels%20remain%20alarming,previous%20high%20reached%20in%202020.>

36 "Food price crisis should have been avoided—experts." International Panel of Experts on Sustainable Food Systems. May 2022. [https://ipes-food.org/\\_img/upload/files/Food%20price%20crisis%20report\\_press%20release.pdf](https://ipes-food.org/_img/upload/files/Food%20price%20crisis%20report_press%20release.pdf).

37 "Another perfect storm?" International Panel of Experts on Sustainable Food Systems. May 2022. <https://ipes-food.org/pages/foodpricecrisis>

38 "A Global Food Import Financing Facility (FIFF): Responding to soaring food import costs and addressing the needs of the most exposed." UN Food and Agriculture Organisation. June 2022. <https://www.fao.org/3/cb9444en/cb9444en.pdf>.

39 "As Conflict and Climate Change Bite, Are High Food Prices Here to Stay?" Voice of America. May 2022. <https://www.voanews.com/a/as-conflict-and-climate-change-bite-are-high-food-prices-here-to-stay-/6560571.html>.

40 "Another perfect storm?" International Panel of Experts on Sustainable Food Systems. May 2022. <https://ipes-food.org/pages/foodpricecrisis>

## BOX 2: Structural factors like climate change are driving weakness

An Intergovernmental Panel on Climate Change (IPCC) assessment report in 2019 stated that climate change and related biodiversity loss “have affected the productivity of all agricultural and fishery sectors, with negative consequences for food security and livelihoods.”<sup>41</sup> A changing climate affects food security because it warms temperatures, changes precipitation patterns and leads to a greater frequency of extreme events.<sup>42</sup> Climate change is a threat multiplier for hunger, as it exacerbates food insecurity, extreme poverty and inequitable access to natural resources, including water.<sup>43 44</sup> The GFSI has shown that under a changing climate access to water is most at risk, and this is strongly linked to cost and conflict.

Beyond the challenge of feeding humanity on an overheating planet, climate shocks like droughts, heatwaves and floods are threat multipliers in other areas—they increase conflict risks, creating climate refugees, social unrest and insurgency.<sup>45 46</sup> These climate shocks make food more expensive and exacerbate existing vulnerabilities, with long-lasting implications for nutritional security.

Women are particularly susceptible. The greater the gender inequality in the GFSI, the lower the score for sustainability and adaptation. The GFSI shows that gender inequality goes hand in hand with having lower access to fresh clean water and land resources and lower political commitment to adaptation and sustainable agricultural practices.

A 2022 IPCC report states that a changing climate would lead to yield decreases in nutrient-rich food, as well as decreases in the nutrient content of staple foods.<sup>47</sup> Furthermore, food systems are becoming less resilient when it comes to fostering diversity. A key concern is how much organic carbon is present

in the soil used for growing. High levels of organic carbon stabilise soil structure, reduce erosion, improve fertility and enhance how much water is held in the earth. However nations included in the GFSI scored very poorly when it came to this measure, with a global norm of only 29.1 out of 100. This underscores the urgent need to boost nutrients in the soil to drive higher yields, greater biodiversity and overall food security. There is also declining diversity in energy sources used and lower biodiversity in agriculture, and diets are static.<sup>48</sup> The GFSI shows an increase in agricultural water risk, which is tied to a drop in dietary diversity.

The inaugural UN Food Systems Summit, held in 2021, acknowledged for the first time the need for a sustainable food system to feed more people and noted the interconnection of food, climate and health.<sup>49</sup> Weather-related disasters have surged fivefold over 50 years.<sup>50</sup> When shocks occur more frequently it is difficult for countries, regions or farmers to sufficiently recover in the meantime, making investments in building food systems resilience key.

A key recognition is that food systems and climate change are inextricably linked. This demonstrates how much potential there is to design agrifood systems that are good for people and the planet, and how agriculture needs to be made part of the solution to remove greenhouse gases from the atmosphere.<sup>51</sup>

“Climate change cannot be restrained without attention to food system emissions, and food security for all cannot be provided without resilience to increasing climate extremes,” 2022 World Food Prize winner Cynthia Rosenzweig said in an IPCC press release in May.<sup>52 53</sup>

41 “Special report on climate change and land. Summary for policymakers.” Intergovernmental Panel on Climate Change. 2019. <https://www.ipcc.ch/srccl/chapter/summary-for-policymakers/>.

42 Ibid.

43 “How climate change increases hunger—and why we’re all at risk.” Concern USA. Y 2022.

<https://www.concernusa.org/story/climate-change-and-hun-ger/#:~:text=The%20more%20climate%20changes%20and,%2D%20and%20middle%2Dincome%20countries.>

44 Ibid.

45 “Unpacking the Climate Security Nexus: Seven Pathologies Linking Climate Change to Violent Conflict.” The Hague Centre for Strategic Studies. March 2022.

<https://hcss.nl/wp-content/uploads/2022/03/Unpacking-the-Climate-Security-Nexus-HCSS-2022-1.pdf>.

46 “Beyond borders: Out changing climate—its role in conflict and displacement.” Environmental Justice Foundation. 2017. <https://ejfoundation.org/resources/downloads/BeyondBorders.pdf>.

47 “Climate Change 2022: Impacts, Adaptation and Vulnerability.” Intergovernmental Panel on Climate Change. 2022. <https://www.ipcc.ch/report/ar6/wg2/>.

48 “The state of the world’s biodiversity for food and agriculture.” UN Food and Agriculture Organisation. 2019. <https://www.fao.org/3/CA3129EN/CA3129EN.pdf>.

49 “World leaders commit to tackling global hunger, climate change and biodiversity loss at historic UN Food Systems Summit.” UN. September 2021.

<https://www.un.org/en/food-systems-summit/news/world-leaders-commit-tackling-global-hunger-climate-change-and-biodiversity-loss>.

50 “Climate and weather related disasters surge five-fold over 50 years, but early warnings save lives - WMO report.” UN News. September 2021. <https://news.un.org/en/story/2021/09/1098662>.

51 “EU organizations join forces with farmers to fight climate change.” World Economic Forum. January 2022.

<https://www.weforum.org/agenda/2022/01/european-organizations-join-forces-with-farmers-to-fight-climate-change-and-restore-nature/>

52 “2022 World Food Prize Awarded to Former IPCC Author Cynthia Rosenzweig.” Intergovernmental Panel on Climate Change. May 2022.

<https://www.ipcc.ch/2022/05/06/2022-world-food-prize-award-cynthia-rosenzweig/>.

53 “2022 Rosenzweig.” World Food Prize Foundation. 2022. [https://www.worldfoodprize.org/en/laureates/2022\\_rosenzweig/](https://www.worldfoodprize.org/en/laureates/2022_rosenzweig/).

### Shocks weakening resilience

The confluence of these shocks is weakening the overall resilience of the global food system, affecting how well stakeholders are able to prepare for, withstand and recover from disruptions to ensure a sufficient supply of acceptable and accessible food for all.

Food availability and access, and the sustainability of the environment that underpins this availability, highlights the vulnerability of the system amid a growing recognition that stakeholders need to look at the food system as a whole. Stakeholders must look beyond just the consumer end of the food system, with its focus on affordability and quality, and towards the intricacies of producing food in an increasingly volatile and warming world. This includes looking at how resilient and accessible inputs are for farmers, how resilient the infrastructure is that supports them, whether there are political and social barriers to overcome, the sustainability of the environment itself, and how quickly stakeholders can adapt to disruptions. The GFSI’s increased focus on farming-focused metrics enables us to examine the important issue of the supply of food and the need to focus resources on the early stages of the global food system.

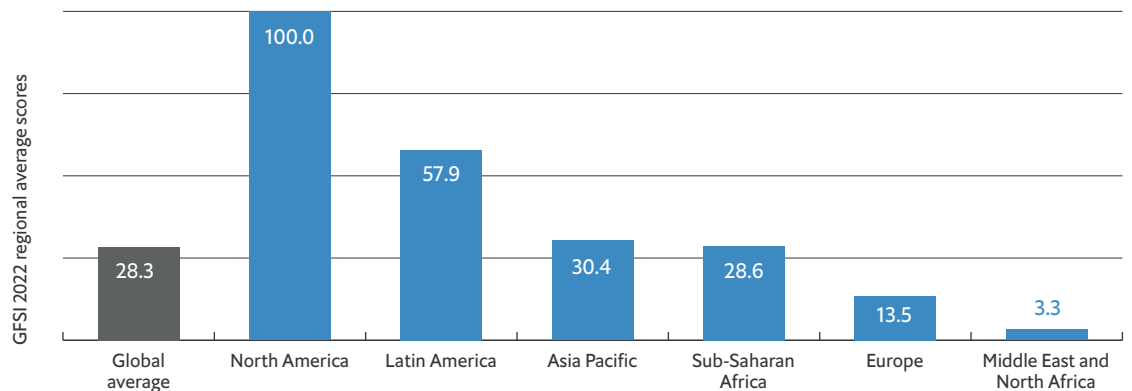
Any weakness of production has repercussions for the rest of the food system. This is particularly true when there are systemic inequalities in the system. For example, the weak status of women farmers drives food security down over time. Women are key players in agriculture, but they often lack access to inputs, and without a strategy to support their inclusion, agency and resilience is challenged more when shocks affect the system. The average score on the “Empowering women farmers” metric among the 113 nations in the 2022 GFSI is only 28.3, and few countries have a national policy to support women and improve their access to inputs even as

**Table 1**  
**Biggest challenges**  
(list of lowest scoring indicators 2022)

Availability		
2.1.3)	Agriculture producer prices	23.7
2.1.6)	Empowering women farmers	28.3
2.2.1)	Public expenditure on R&D	29.2
2.3.2)	Irrigation infrastructure	20.5
Sustainability and adaptation		
4.3.4)	Soil organic content	29.1

### Global performance on commitment to empowering women farmers in 2022

Across the world, the support for women farmers remains low.



Source: Global Food Security Index 2022.

**Table 2**  
**Biggest percentage drop in scores**  
(2019-2022)

<b>Affordability</b>		
	Overall affordability	-3.9%
1.1)	Change in average food costs	-11.5%
1.4)	Agricultural trade	-3.1%
1.4.2)	Trade freedom	-6%
1.5)	Food safety net program	-4.2%
1.5.2)	Funding for food safety net programs	-15.6%
<b>Availability</b>		
2.6.3)	Air, port and rail infrastructure	-3.7%
2.7)	Sufficiency of supply	-3%
2.7.2)	Dependency on chronic food aid	-7.5%
2.8)	Political and social barriers to access	-2.1%
2.8.1)	Armed conflict	-4.2%
2.8.2)	Political stability risk	-6%
<b>Quality and safety</b>		
3.2)	Nutritional standards	-10.6%
3.2.2)	National nutrition plan or strategy	-19.6%
3.2.4)	Nutrition monitoring and surveillance	-10.2%
3.5.1)	Relevant food safety legislation	-4.2%

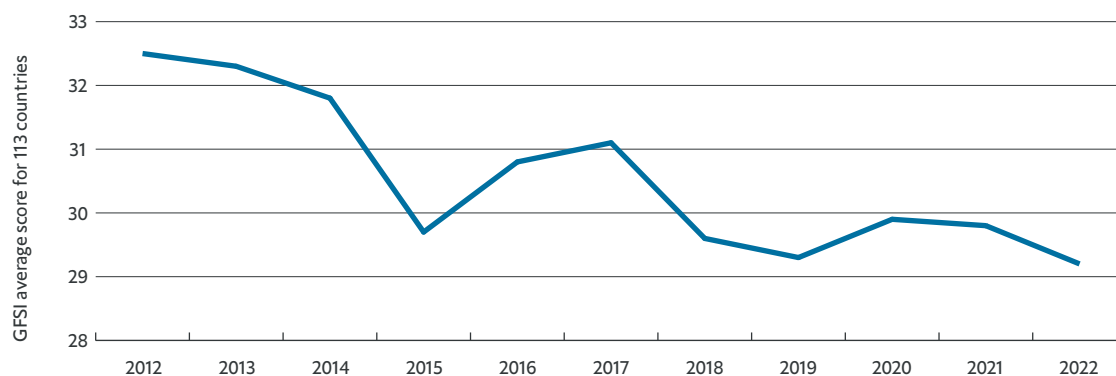
shocks roil the system. However, there are marked regional differences. North America scored 100 for its commitment to women, but the Middle East and North Africa only scored 3.3; surprisingly, perhaps, Europe only scored 13.5.

The interconnectedness of the food system can be seen in the way that political and social barriers to access, such as armed conflicts and political instability, can have effects in other areas, including declines in trade freedom, and in air, port and rail infrastructure (see Table 2). The GFSI shows that political and social factors compound the inequalities in the system, further weakening resilience by affecting sufficiency of supply and leading to a greater dependency on chronic food aid as average food costs soar.

A drastic weakening in the ability to feed global populations and to fund food safety nets is compounded by intrinsic and deep-rooted problems with the environment, which require complicated solutions that take time to resolve. For example, few nations have irrigation systems set up for their cultivated lands, with the global score reaching only 20.5 out of 100 (see Table 1). And when it comes to the sustainability and adaptation pillar of the food system, most of the 113 nations' scores are stagnant in 2022. Nations average a

### Global public expenditure on agricultural R&D, 2012-22

The global average score for public spending on agricultural R&D has declined since 2012.



Source: Global Food Security Index 2022.



score of 40 in how they have committed to manage exposure and co-ordinate risks. Water is a key area of concern, whether because of flooding, droughts, pollution, scarcity, eutrophication or marine biodiversity. The global score for all of the above (except for flooding) is around 40. Susceptibility to more frequent disruptions from droughts or flooding can lead to unpredictable crop loss and declines in food supply, while pollution can impact the quality and availability for water for agriculture.

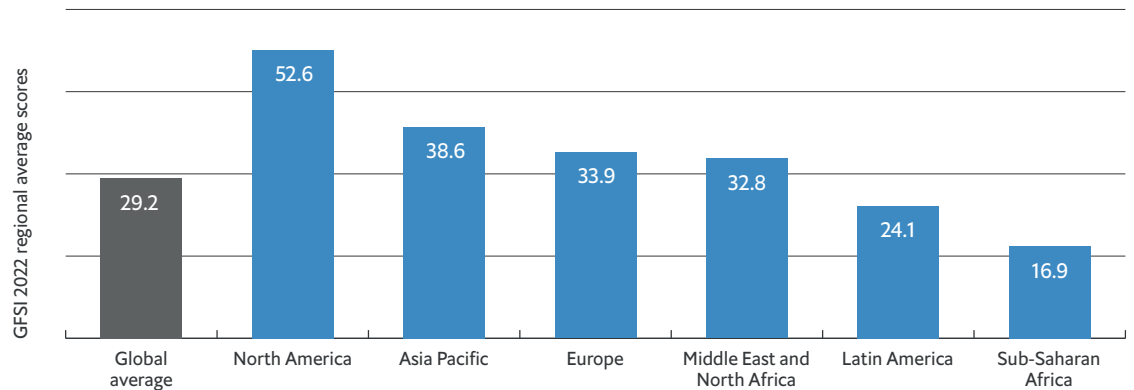
To overcome shocks, governments need to invest in research and development (R&D) to ensure long-term resilience and sustainability.<sup>54</sup> Research shows that spending on R&D generates high returns, not only in terms of boosting productivity,

but also in broader welfare outcomes, such as poverty reduction.<sup>55</sup> But this measure is among the lowest scoring in the 2022 GFSI index, with a global average of 29.2 dragged down by Sub-Saharan Africa and, to a lesser extent, Latin America. Furthermore, public expenditure on R&D has dropped by 10% since 2012.

Frequent shocks are overlapping to weaken resilience, yielding the most extreme and immediate threat to global food security since the inception of the GFSI in 2012. Achieving zero hunger by 2030—the second of the 17 UN SDGs—may prove unfeasible unless interventions tackle deep-seated systemic issues.

### Global public expenditure on agricultural R&D, 2022

*In 2022, Latin America and Sub-Saharan Africa score below the global average for spending on agricultural R&D.*



Source: Global Food Security Index 2022.

<sup>54</sup> "Food systems - Research and innovation investment gap study" European Commission. June 2022. [https://ec.europa.eu/info/news/food-systems-research-and-innovation-investment-gap-study-2022-jun-15\\_en](https://ec.europa.eu/info/news/food-systems-research-and-innovation-investment-gap-study-2022-jun-15_en)

<sup>55</sup> "Public expenditure in agriculture: trends, "black boxes", and more." International; Food Policy Research Institute. January 2016. <https://www.ifpri.org/blog/public-expenditure-agriculture-trends-%E2%80%9Cblack-boxes%E2%80%9D-and-more#>

# Chapter 3

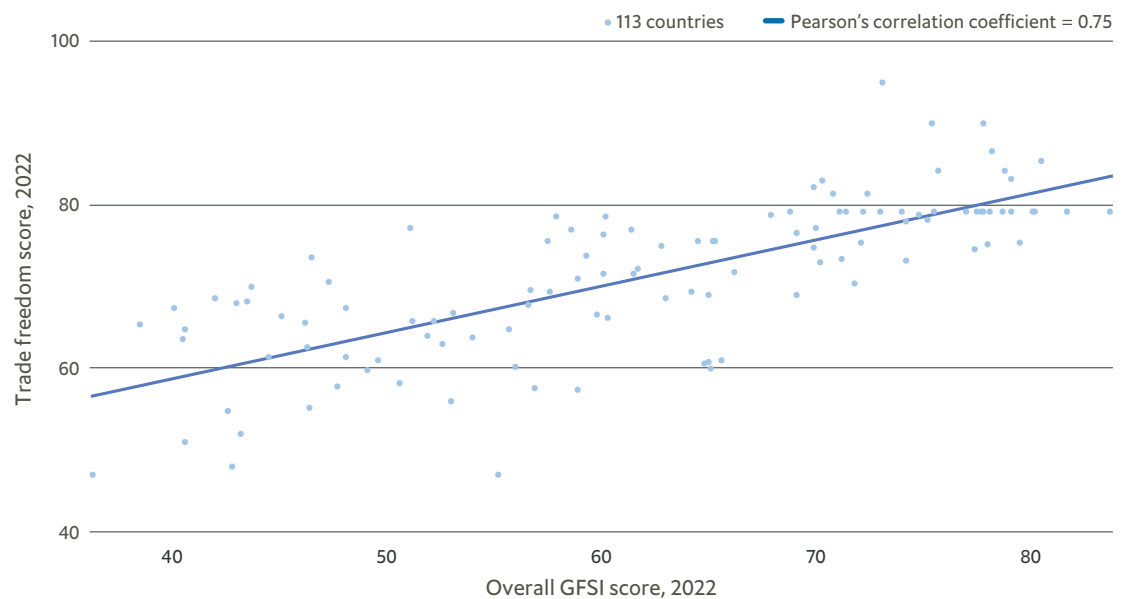
## Efforts to build food system resilience must be multidimensional and multilateral

Humanitarian measures by governments and NGOs are necessary to offset the impact of short-term shocks to the food system in the face of what the UN has called a “perfect storm” of crises.<sup>56</sup> Such measures typically include price controls, the release of strategic supplies, and foreign aid to make food affordable and of good quality.

Emergency funding can be used to increase food aid, especially via emergency food programmes like the WFP, both during times of conflict and amid record food prices and climate shocks.<sup>57 58</sup> The presence of a food safety net in a country strongly correlates with a good overall GFSI score in 2022.

### Overall GFSI score vs trade freedom score, 2022

There is a strong positive association between overall food security scores and trade freedom scores.



For details on the country specific scores and ranking, please visit the website.  
Source: Global Food Security Index 2022.

<sup>56</sup> “Ukraine war unleashing a ‘perfect storm’ of crises, warns UN chief.” UN News. April 2022. <https://news.un.org/en/story/2022/04/1116152>.

<sup>57</sup> “Secretary-General’s Policy Brief. Investing in Jobs and Social Protection for Poverty Eradication and a Sustainable Recovery.” UN. September 2021. <https://unsdg.un.org/sites/default/files/2021-09/SG-Policy-Brief-on-Jobs-and-Social-Protection-Sept%202021.pdf>.

<sup>58</sup> “In Focus: FAO responds to the Ukraine crisis.” UN Food and Agriculture Organisation. <https://www.fao.org/in-focus/policy-proposals/en>.

Trade, food security strategies and setting nutritional standards are also necessary drivers for food security. Bringing down food costs requires trade freedom and farmer support; the FAO has said that financing facilities are needed for countries that are big food importers.<sup>59</sup> <sup>60</sup> Imposing trade or export restrictions should be avoided and price volatility should be minimised while tackling commodity speculation, and debt relief should be given priority.<sup>61</sup> This year's GFSI shows a strong link between trade freedom and food security.

in sustainable practices, programmes and commitments. This can include improving land management, increasing soil organic carbon content, adopting sustainable sourcing, improving energy use, and reducing pollution, food waste and post-harvest losses.<sup>64</sup>

Adapting to a changing climate and promoting agricultural resilience, rather than just reacting to shocks, will ensure that everyone is fed with nutritious food. Indeed, the GFSI shows that this is what nations are most re-orienting towards, with four of the five biggest rises in the index since 2019 coming from political commitments to adaptation (see Table 3). This includes a hefty 25.6% jump in environmental economic accounting, an 18.5% jump in risk-management coordination, a 16.6% jump in climate finance flows and a 13.7% jump in sustainable agriculture. There have also been big jumps in national agriculture adaptation policy (16%) and pest infestation and disease mitigation (11.3%), along with a smaller jump in commitments to sustainable agriculture practices (3.6%).

This re-orienting is important because sustainable food production requires putting systems in place so that there is still integrity in the availability of food—that is, farmers can still farm and grow crops—when extreme weather events strike.

A holistic approach to food needs to focus not just on policy, but on a political will to integrate all sectors, including the private sector. This demands renewed engagement and action by all players in the food supply system—governments, businesses, consumers and NGOs. Through concerted initiatives, public, private and non-governmental entities are best-placed to address many of the core drivers of food insecurity, ultimately

**Through concerted initiatives, public, private and non-governmental entities are best-placed to address many of the core drivers of food insecurity, ultimately strengthening a sustainable food system and improving its capacity to withstand shocks.**

However, building long-term, systemic resilience must also be a priority if the larger trend towards greater food insecurity worldwide is to be reversed. There is no single, overall solution to enhance food system resilience, as each context and location needs to be considered and a prescriptive approach to a specific component may have a negative impact on other components.<sup>62</sup> Enhancing the resilience of the global food system will require a mix of robustness, recovery, reorientation and reorganisation to suit the location and the scale of need.<sup>63</sup>

Emphasis must go towards buttressing the supply of food and the environment that supports it, ensuring that producers are supported and can adapt to a changing climate through shifts

59 "Surging food prices: FAO calls for import financing facility for poorer nations at G20 meeting." Re-liefWeb. April 2022. <https://reliefweb.int/report/world/surging-food-prices-fao-calls-import-financing-facility-poorer-nations-g20-meeting>.

60 "A Global Food Import Financing Facility (FIFF): Responding to soaring food import costs and addressing the needs of the most exposed." UN Food and Agriculture Organisation. June 2022. <https://www.fao.org/3/cb9444en/cb9444en.pdf>.

61 "Another perfect storm?" International Panel of Experts on Sustainable Food Systems. May 2022. <https://ipes-food.org/pages/foodpricecrisis>

62 "Resilience of the UK Food System in a Global Context." Global Food Security programme. Accessed August 2022. <https://www.foodsecurity.ac.uk/research/food-system-resilience/>

63 Ibid.

64 "Potential global contribution of response options to mitigation, adaptation, combating desertification and land degradation, and enhancing food security." Intergovernmental Panel on Climate Change. November 2019. <https://www.ipcc.ch/site/assets/uploads/sites/4/2019/11/SPM3A-approval-v4-USletter.png>

**Table 3**  
**Largest rises in the GFSI, 2019-2022**

	<b>Pillar or indicator</b>	<b>Percent increase from 2019 to 2022</b>
2.1)	Access to agricultural inputs	4.2%
2.1.1)	Access to finance and financial products for farmers	3.1%
2.1.2)	Access to diversified financial products	6.9%
2.1.3)	Agriculture producer prices	13.4%
2.1.6)	Empowering women farmers	18.5%
2.2)	Agricultural research & development	6.8%
2.2.2)	Access to agricultural technology, education and resources	10.2%
2.2.3)	Commitment to innovative technologies	6.9%
2.9)	Food security and access policy commitments	10.7%
2.9.1)	Food security strategy	13.3%
2.9.2)	Food security agency	5.7%
3.5.2)	Food safety mechanisms	6.1%
	<b>Sustainability and adaptation pillar</b>	<b>3.9%</b>
4.5)	Political commitment to adaptation	10.4%
4.5.1)	Climate finance flows	16.7%
4.5.2)	Environmental- economic accounting implementation	25.7%
4.5.5)	National agricultural adaptation policy	16.1%
4.5.6)	Sustainable agriculture	3.6%
4.6)	Disaster risk management	13.7%
4.6.1)	Pest infestation and disease mitigation	11.3%
4.6.2)	Risk management coordination	18.7%

strengthening a sustainable food system and improving its capacity to withstand shocks. The political will to build resilience is taking shape at the highest levels, with the UN in March 2022 setting up a global crisis response group on food, energy and finance, followed by the World Bank in April calling for co-ordinated action on food security.<sup>65 66</sup> In mid-May the World Bank joined forces with the Group of Seven (G7) nations to set up a global alliance for food security.<sup>67 68</sup> It is imperative that these sorts of initiatives include the private sector, taking

advantage of its creative mindset to find solutions to grow, develop and process food through technology and innovations. This innovation, nurturing and educating of consumers and farmers across generations forms the foundations of a sustainable food supply.

The 2022 GFSI shows that nations are more likely to have higher global food security scores where farmers have access to agricultural inputs and financial products, governments invest in R&D and innovative

65 "Guterres unveils first recommendations of UN crisis group, set up in wake of Ukraine invasion." UN News. April 2022. <https://news.un.org/en/story/2022/04/1115622>

66 "Joint Statement: The Heads of the World Bank Group, IMF, WFP, and WTO Call for Urgent Coordinated Action on Food Security." World Bank. April 2022. <https://www.worldbank.org/en/news/statement/2022/04/13/joint-statement-the-heads-of-the-world-bank-group-imf-wfp-and-wto-call-for-urgent-coordinated-action-on-food-security>

67 "Food Security Update." World Bank. August 2022. <https://www.worldbank.org/en/topic/agriculture/brief/food-security-up-date#:~:text=Globally%2C%20hungary%20levels%20remain%20alarming%20high%20reached%20in%202020>

68 "Joint statement: G7 Presidency, World Bank Group Establish Global Alliance for Food Security to Catalyze Response to Food Crisis." World Bank. May 2022. <https://www.worldbank.org/en/news/statement/2022/05/19/joint-statement-g7-presidency-wbg-establish-global-alliance-for-food-security>

technology, and supply-chain infrastructure is strong. Indeed, countries with access to agricultural inputs have seen some of the biggest rises in the index since 2019, especially commitments to empowering female farmers (with scores jumping by 18.4%); access to agricultural technology, education and

resources (up by 10.1%); commitment to using innovative technology (rising 7%); and prioritising food security strategies. These interventions are important because they have an outsized impact, not only on availability, but also in terms of sustainability, affordability, and quality and safety.

### BOX 3: South Korea

South Korea tops the GFSI when it comes to agricultural R&D, scoring 85.9 out of 100, showcasing how robust agricultural infrastructure and inputs can transform a sector. The country, with a population of 51.7m people, is joint top with five other nations when it comes to its public expenditure on R&D in this year's index, scoring 100. It also sits in the top grouping of GFSI nations for having a strategy on agricultural innovation. The country's Rural Development Administration (RDA) employs more than 1,000 people and had a budget of US\$997m in 2021.<sup>69</sup> The RDA has four bureaus, respectively focusing on planning, research policy, extension services and technology co-operation. It also has four national institutes covering agricultural, crop, horticultural/herbal and animal science. On top of this, South Korea also has a public institute that covers agricultural technology, commercialisation and transfer. Its work is widespread, feeding into nine provincial agricultural research extension services and 156 city- or county-level agricultural technology centres. The country has a culture of sharing innovations with the world.<sup>70</sup>

South Korea is strong in finance, sitting in the top grouping in the GFSI for having affordable financial services (savings and credit) for all farmers and access to diversified financial

products. The country also gives farm businesses direct payments if they meet certain requirements.

South Korea displays strong achievements when it comes to adapting to a warming world. It has set up early-warning systems for climate change, offering farms in 29 counties information through the internet and mobile phones. It has also set carbon-neutral agriculture targets for 2050, promotes biodiversity conservation and hosts a national gene bank, incorporating one of the world's largest seed vaults.<sup>71</sup> It touts smart farming that controls environmental factors like temperature, light, water, nutrients, energy and automation. It also promotes data-focused digital agriculture in all stages of the food system and uses a GIS-based soil system that directs which crops and fertilisers are used.

All of these efforts have resulted in South Korea being able to reorient its food system outcomes—productivity increased by 65.4% in 1970–2020, while labour hours decreased by 92.3% over the same period.<sup>72</sup> The GFSI also reveals that the country has low volatility of production, low food loss, strong sufficiency of supply, high food safety, and top marks for disaster risk management and its safety net programme, the latter resulting in very few of its population residing under the poverty line.

69 "Achievements & Challenges in R&D to Strengthen the Sustainability of Agriculture in Korea." Rural Development Administration, Republic of Korea. September 2021. [https://www.cepal.org/sites/default/files/presentations/un\\_eclac\\_tr\\_kwon\\_2021.9.9\\_vf.pdf](https://www.cepal.org/sites/default/files/presentations/un_eclac_tr_kwon_2021.9.9_vf.pdf)

70 Ibid.

71 Ibid.

72 Ibid.

### Innovate in all parts of food system

The GFSI data highlight the threats to agricultural production posed by climate change and other risks. The demand is not just for more food, but for more nutritious food—and more responsive supply chains that are responsible for less food waste and less damage to the environment. Farmers will need to grow more food on the same land with less inputs, requiring innovation in all parts of the food system.

Innovation is essential to building resilience.<sup>73</sup> Systemic innovations in particular are needed to enhance the resilience of food system outcomes, either by adapting food system activities to maintain or return to the status quo (yielding robustness and recovery) or to transform the outcomes (through re-orienting).<sup>74</sup> Resilient food systems are more able to generate innovative solutions to avoid shocks, while innovation promotes new forms of organisation and

transformation including moving to circular agrifood systems and promoting diversity as an engine for resilience.<sup>75</sup>

Apart from mega-technological trends like digital farming tools and nanotechnologies, there is also potential in simpler, internetworking or platforming technologies that promote new ways of sharing and organising. This could include farmers sharing services used to deliver the food that they grow, or using digital equipment-sharing platforms so that they don't have to buy expensive farming machinery themselves. It could also include small-scale micro-innovations, like tinkering or re-assembling existing technologies at low-cost that sustain small-scale farming resilience at the local level.<sup>76</sup>

Climate resilience, too, can be built into agriculture to counter both stresses and shocks. Making commitments to sustainable agricultural practices and adaptation is strongly linked to scoring highly

### Overall GFSI score vs political commitment to adaptation, 2022

There is a strong positive association between overall food security scores and scores for political commitment to adaptation.



For details on the country specific scores and ranking, please visit the website.  
Source: Global Food Security Index 2022.

73 Charatsari C, Lioutas ED, De Rosa M, Vecchio Y. "Technological Innovation and Agrifood Systems Resilience: The Potential and Perils of Three Different Strategies." *Front Sustain Food Syst.* April 2022. <https://www.frontiersin.org/articles/10.3389/fsufs.2022.872706/full>  
74 "Resilience of the UK Food System in a Global Context." Global Food Security programme. Accessed August 2022. <https://www.foodsecurity.ac.uk/research/food-system-resilience/>  
75 Charatsari C, Lioutas ED, De Rosa M, Vecchio Y. "Technological Innovation and Agrifood Systems Resilience: The Potential and Perils of Three Different Strategies." *Front Sustain Food Syst.* April 2022. <https://www.frontiersin.org/articles/10.3389/fsufs.2022.872706/full>  
76 Ibid.

on overall food security in the 2022 GFSI. These practices could include crop rotation, permaculture, intercropping and agroforestry.

Novel food products like plant-based meat substitutes and cell-cultured fish, alongside novel planting methods like vertical farming, are part of the re-orientation of the food system. By changing the way that food is produced, these new methods introduce alternative options during, before and after disruptions. These products also meet nutritional needs as well as national food security strategies, and reduce the impact of food production on the environment. This type of re-orientation is taking place in the agrifood industry, with innovations that try to improve land productivity through higher yields and use green chemistry and technology to optimise how crops are grown through the seasons. Agri-biotechnology is another area of innovation that can support climate-resilient agricultural production. Plant science and crop protection are also key centres of focus.

## As commitments to **innovative climate financing** grow, the 2022 GFSI shows a strong link between being food secure and being able to access market data and mobile banking.

Finance, too, can improve the robustness of the food system, aid in its recovery and re-orient the sector into new and alternative outcomes. As commitments to innovative climate financing grow, the 2022 GFSI shows a strong link between being food secure and being able to access market data and mobile banking. Finance is a big winner in 2022, with the GFSI showing rises across the board since 2019 for finance and financial products, including diversified ones, along with climate finance flows

and environmental economic accounting (see Table 3). Transformative finance and partnerships tailored to local ecosystems and finding local solutions also have potential.<sup>77</sup> And critical to centering the food system on climate, nature and resilience is the development and deployment of market-based incentives—such as carbon markets—that signal to stakeholders along supply chains that there is value beyond productivity.<sup>78</sup>

### Use data management and digital technology to lower food costs and adapt to climate change and other shocks

Stakeholders can work together to systematically collect and analyse data in all areas of the food system, from production and distribution to consumption. This will help to boost resilience before and after shocks, and help to transform the sector. For example, timely access to seasonal forecasts and early-warning information, alongside systems that identify shocks and risks, can help farmers to decide when and what to plant, and to anticipate, adapt to and cope with possible shocks.<sup>79</sup> Precision agriculture, which harnesses advances in technology to ensure optimal health and productivity of crops and soils, can reduce the need for inputs.<sup>80</sup> Farmers can use digital technology to be much more specific and accurate in applying fertiliser in the field, while organisations can use information technology to connect producers in a web as opposed to a single supply chain.

The Internet of Things (IoT), drones and artificial intelligence (AI) can collect, monitor and analyse data to improve farm productivity and cut food waste, alongside reducing costs.<sup>81</sup> This can work at a smaller scale, such as with the use of AI tools that give farmers data to maximise yield and adopt

77 "100 million farmers." World Economic Forum. <https://www.weforum.org/communities/100-million-farmers>

78 Ibid.

79 Sperl F. "Strengthening the resilience of our global food system while advancing its transformation." IIASA. October 2021. <https://blog.iiasa.ac.at/2021/10/06/strengthening-the-resilience-of-our-global-food-system-while-advancing-its-transformation/>

80 Ibid.

81 "Food 4.0: Technology in Agriculture and Food." Economist Impact. November 2021. <https://impact.economist.com/perspectives/technology-innovation/food-40-technology-agriculture-and-food>

more sustainable practices.<sup>82</sup> Advanced analytics can help to better manage agricultural supply chain shocks.<sup>83</sup> Stakeholders can also work together to better compile and compare data from different sectors to assess the performance of the food system and inform decision-making, especially in the face of mounting shocks.

### Set up local systems to generate and disseminate knowledge to prepare for and adapt to shocks and find local solutions

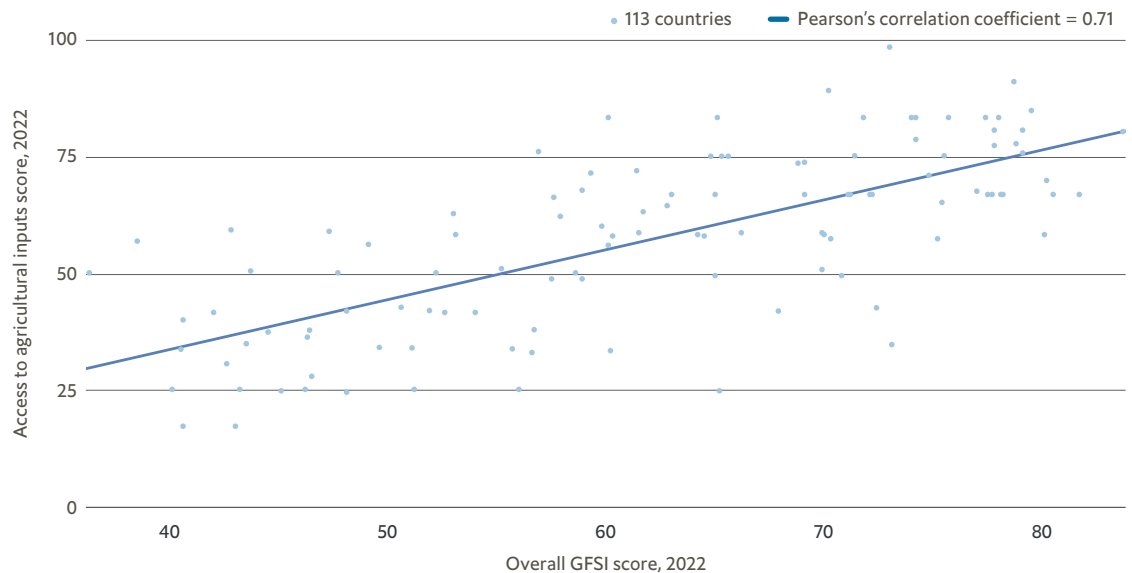
The GFSI shows that farmers do better if they have access to local and regional knowledge providers such as extension services, co-operatives, research institutes, private companies, laboratories and knowledge networks. Agricultural extension

services can offer technical advice and new ideas to farmers, and can also supply them with the necessary inputs and services to support their production. Being able to access these types of services is strongly linked to scoring highly on overall food security in the 2022 GFSI. In particular, it reveals a strong and positive correlation between the overarching indicator of access to agricultural inputs and the overall food security score.

Key also is building up farmers' knowledge, as well as trust and buy-in among stakeholders, to find practical solutions tailored to local food systems and the natural ecosystems that they depend on.<sup>84</sup> Among such solutions are plans to stop pest infestations and mitigate disease, and the GFSI showed a growing commitment in these two areas.

### GFSI Overall score vs access to agricultural inputs, 2022

*There is a strong positive association between overall food security scores and scores for access to agricultural inputs.*



For details on the country specific scores and ranking, please visit the website.  
Source: Global Food Security Index 2022.

82 "Farmers need practical innovation, not moonshots, to stave off global food crisis." World Economic Forum. September 2021. [https://www.weforum.org/forum\\_networks/100-million-farmers/articles/agriculture-farming-innovation-technology](https://www.weforum.org/forum_networks/100-million-farmers/articles/agriculture-farming-innovation-technology)

83 "How advanced analytics can address agricultural supply chain shocks." McKinsey. April 2022. <https://www.mckinsey.com/industries/agriculture/our-insights/how-advanced-analytics-can-address-agricultural-supply-chain-shocks>

84 "100 million farmers." World Economic Forum. <https://www.weforum.org/communities/100-million-farmers>



#### BOX 4: Farmer-centric innovation

The UN's Food Systems Summit, held in 2021, recognised innovation as key to transforming the global food system, and a number of initiatives have emerged to boost farmer-centric innovation.<sup>85</sup> The World Economic Forum and the FAO have come up with a roadmap to help countries to accelerate such innovation.<sup>86</sup> Part of the roadmap recommends establishing a global coalition for digital food systems innovation, uniting public, private and non-profit groups to promote digital data ecosystems in the sector.<sup>87</sup> A network of food innovation hubs also seeks to join stakeholders in leveraging knowledge, technology, data and institutional capacity to develop local innovation ecosystems for local needs.<sup>88</sup> The roadmap aims to help farmers invest in sustainable food practices through the 100 Million Farmers multi-stakeholder platform<sup>89</sup>, which is catalysing action towards net-zero, nature-positive food systems by 2030.<sup>90</sup> As part of this platform, the Carbon + Farming Journey coalition in Europe puts farmers at the centre of innovation in a bid to achieve food security and net-zero climate goals at the heart of the European Green Deal.<sup>91</sup> <sup>92</sup> Solutions will need to be localised to other regions (what works in Europe will not always work elsewhere), but there are important lessons in terms of bringing stakeholders together and developing local solutions to grow resilience.

A survey of 1,600 farmers carried out by the Carbon + Farming Journey coalition showed the challenges that farmers face. Because farmers earn 60% less than non-farming families, they are unable to invest in climate-smart agricultural solutions. Just one in four farmers have good or very good knowledge about these solutions, and there is an uneven adoption of technology amid fragmented national policies.<sup>93</sup> Given these challenges, a number of spaces were identified as crucial to accelerate change, including better financing and risk management, supportive innovation ecosystems and policies, and education and awareness campaigns.<sup>94</sup>

The above solutions cannot work alone—collaboration needs to take place across the whole food system, ranging from inputs like seed provision, fertilisers, finance and extension services to farmers being supported by strong supply chains and broader social, economic and environmental policies. For example, the 100 Million Farmers initiative draws on what it calls “lighthouse” projects to bring together innovation, data, transformative finance and partnerships and adapt these locally. For its part, the World Bank is working in eastern and southern Africa to enhance the resilience of food systems, offering what it says are opportunities to go beyond tackling food insecurity to generating more jobs and promoting trade.<sup>95</sup>

85 “The Food Systems Summit.” UN. 2021. <https://www.un.org/en/food-systems-summit>.

86 “Transforming Food Systems: Pathways for Country-led Innovation.” World Economic Forum/UN Food and Agriculture Organisation. January 2022. <https://www.weforum.org/communities/food-systems-innovation#:~:text=Global%20Coalition%20for%20Digital%20Food,digital%20innovation%20in%20food%20systems>

87 Ibid.

88 Ibid.

89 “100 million farmers.” World Economic Forum. <https://www.weforum.org/communities/100-million-farmers>

90 “How inclusive innovation could transform food systems—and help to end world hunger.” World Economic Forum. March 2022.

<https://www.weforum.org/agenda/2022/03/food-systems-innovation-transformation/>.

91 “New Coalition Announces Bold Plan to Decarbonize Europe’s Food System.” EIT Food. May 2021.

<https://www.eitfood.eu/news/new-coalition-announces-bold-plan-to-decarbonize-europes-food-system>

92 Ibid.

93 “Transforming Food Systems with Farmers: A Pathway for the EU.” World Economic Forum. April 2022.

[https://www3.weforum.org/docs/WEF\\_Transforming\\_Food\\_Systems\\_with\\_Farmers\\_A\\_Pathway\\_for\\_the\\_EU\\_2022.pdf](https://www3.weforum.org/docs/WEF_Transforming_Food_Systems_with_Farmers_A_Pathway_for_the_EU_2022.pdf)

94 Ibid.

95 Kray H, Shetty S, Colleye P. “Three challenges and three opportunities for food security in Eastern and Southern Africa.” World Bank. 2022.

<https://blogs.worldbank.org/africacan/three-challenges-and-three-opportunities-food-security-eastern-and-southern-africa>.

# Conclusion

The scores in the 2022 GFSI reflect a fragile global food system that is under immense pressure and facing some of its worst outcomes ever. Food prices and hunger are hitting record highs, while affordability is plummeting as shocks like the covid-19 pandemic, armed conflict and climate change compound systemic stresses. These stresses and shocks pose risks that could get worse as threats to food security become the new normal. Stakeholders in all parts of a complex and interconnected food system will need to work together to manage these risks and achieve the twin goals of resilience and sustainability.

A key part of this momentum needs to come from stakeholders such as governments, multilaterals and NGOs. They can use humanitarian, trade, economic and social protection tools to offset the impact of short-term shocks. But this year's GFSI also shows a clear path for other stakeholders, including businesses, farmers and local groups. By working together with governments and NGOs, they have already made inroads on adaptation policy, innovation and finance. The following efforts have been key to preventing the overall GFSI from falling lower than its current level:

- Despite affordability pulling down the GFSI since 2019, the adoption of sustainable policies, particularly in climate finance flows, heralds significant effort by governments, multilaterals and businesses to adapt to and mitigate climate risks. Government efforts to coordinate risk management and introduce environmental economic accounting send a strong signal to businesses to adopt new operating frameworks and reporting requirements that will boost sustainable and resilient agriculture.
- Despite public expenditure on R&D falling by 10% since the GFSI's first year (scoring 29.2 out of 100 in 2022), when it comes to farmer inputs, nations are seeing increased policy commitments to innovative technologies, and greater access to agricultural technology, education and resources. At the same time, farmers are getting better access to finance, including access to diversified financial products that can help to provide crop insurance. This is essential in providing better protection against economic, financial and climate shocks.
- All of these inputs are tied to resilience and powered by the private and public sectors. New tools and processes promote more sustainable farming systems and help farmers and businesses to increase their productivity. Key global initiatives like the 100 Million Farmers platform have focused on placing farmers at the centre of this adaptation and working with multiple stakeholders.

However, to build a food system that is resilient in more turbulent times—one that is robust in response to shocks, can recover from disruptions and can reorient to achieve better outcomes—requires addressing some of the system's biggest and longest enduring shortfalls. The GFSI shows that there are clear gaps and challenges in managing the stress on natural resources:

- Climate change is a threat multiplier, and the GFSI shows that access to water is at risk as nations endure warmer temperatures. Irrigation infrastructure (the percentage of cultivated agricultural area equipped for irrigation) was the lowest scoring of all measures on the index,

remaining largely unchanged in the 11 years of the GFSI, with a score of 20.5. Investments are urgently needed to install, improve or expand smart irrigation infrastructure to ensure a sufficient food supply in a way that is resilient to unpredictable weather events and also protects the environment.

- The situation is not much better when it comes to the soil on which crops are grown or on which livestock graze. Another of the index's lowest scoring measures (at 29.1 out of 100) is soil organic content, which indicates how good the quality of the land is. Urgent investment is needed to boost levels of organic carbon to stabilise soil structure, reduce erosion, improve soil fertility and enhance the ability of soil to hold water.

A key focus now needs to be on finding solutions to these types of intrinsic challenges. These solutions will involve managing natural resources more effectively, ensuring access to water and high-quality soil, and scaling quickly to meet the needs of farmers and the food system. Ultimately, all stakeholders need to work together to build a robust and resilient food system that can withstand wider stresses and shocks amid a demand for more food on limited land amid a warming climate.

# Appendix I: GFSI 2022 results

**Table 1. 2022 GFSI overall rankings table**

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

Rank / 113	Country	Score / 100	Rank / 113	Country	Score / 100	Rank / 113	Country	Score / 100
1	Finland	83.7	39	South Korea	70.2	77	Egypt	56.0
2	Ireland	81.7	40	Panama	70.0	78	Cambodia	55.7
3	Norway	80.5	=41	Malaysia	69.9	79	Sri Lanka	55.2
4	France	80.2	=41	Saudi Arabia	69.9	80	Bangladesh	54.0
5	Netherlands	80.1	=43	Mexico	69.1	81	Laos	53.1
6	Japan	79.5	=43	Russia	69.1	82	Kenya	53.0
=7	Canada	79.1	45	Romania	68.8	83	Ghana	52.6
=7	Sweden	79.1	46	Vietnam	67.9	84	Pakistan	52.2
9	United Kingdom	78.8	47	Jordan	66.2	85	Mali	51.9
10	Portugal	78.7	48	Ecuador	65.6	86	Senegal	51.2
11	Switzerland	78.2	49	Turkey	65.3	87	Botswana	51.1
12	Austria	78.1	50	Kuwait	65.2	88	Rwanda	50.6
13	United States	78.0	51	Brazil	65.1	89	Burkina Faso	49.6
=14	Denmark	77.8	=52	Bolivia	65.0	90	Tanzania	49.1
=14	New Zealand	77.8	=52	Dominican Rep.	65.0	=91	Benin	48.1
16	Czech Republic	77.7	54	Argentina	64.8	=91	Malawi	48.1
17	Belgium	77.5	55	Belarus	64.5	93	Uganda	47.7
18	Costa Rica	77.4	56	El Salvador	64.2	94	Mozambique	47.3
19	Germany	77.0	57	Morocco	63.0	95	Côte d'Ivoire	46.5
20	Spain	75.7	58	Guatemala	62.8	96	Cameroon	46.4
21	Poland	75.5	59	South Africa	61.7	97	Niger	46.3
22	Australia	75.4	60	Honduras	61.5	98	Togo	46.2
23	United Arab Emirates	75.2	61	Serbia	61.4	99	Guinea	45.1
24	Israel	74.8	62	Tunisia	60.3	100	Ethiopia	44.5
=25	Chile	74.2	63	Indonesia	60.2	101	Angola	43.7
=25	China	74.2	=64	Colombia	60.1	102	Zambia	43.5
27	Italy	74.0	=64	Thailand	60.1	103	Chad	43.2
28	Singapore	73.1	66	Azerbaijan	59.8	104	Congo (Dem. Rep.)	43.0
29	Bulgaria	73.0	67	Philippines	59.3	105	Sudan	42.8
30	Qatar	72.4	=68	Algeria	58.9	106	Venezuela	42.6
31	Greece	72.2	=68	India	58.9	107	Nigeria	42.0
32	Kazakhstan	72.1	70	Paraguay	58.6	=108	Burundi	40.6
33	Uruguay	71.8	71	Ukraine	57.9	=108	Madagascar	40.6
34	Hungary	71.4	72	Myanmar	57.6	110	Sierra Leone	40.5
35	Oman	71.2	73	Uzbekistan	57.5	111	Yemen	40.1
36	Slovakia	71.1	74	Nepal	56.9	112	Haiti	38.5
37	Peru	70.8	75	Tajikistan	56.7	113	Syria	36.3
38	Bahrain	70.3	76	Nicaragua	56.6			

## Table 2. Score changes

(Net change in overall score, 2022 versus 2012) Weighted total of all pillar scores (0-100, where 100 = most favourable)

■ Score improved ■ Score declined

Rank / 113	Country	Score / 100
35	Oman	+13.8
=25	China	+13.7
46	Vietnam	+13.4
=52	Bolivia	+12.2
23	United Arab Emirates	+12.0
=41	Saudi Arabia	+11.8
78	Cambodia	+11.4
74	Nepal	+11.1
33	Uruguay	+10.9
89	Burkina Faso	+10.7
90	Tanzania	+10.2
82	Kenya	+10.0
75	Tajikistan	+9.6
29	Bulgaria	+9.5
32	Kazakhstan	+9.4
104	Congo (Dem. Rep.)	+9.3
99	Guinea	+9.3
57	Morocco	+9.1
81	Laos	+9.0
=91	Benin	+8.9
40	Panama	+8.8
84	Pakistan	+8.7
86	Senegal	+8.7
=68	Algeria	+8.4
72	Myanmar	+8.2
61	Serbia	+8.0
24	Israel	+7.8
103	Chad	+7.7
37	Peru	+7.7
60	Honduras	+7.4
85	Mali	+7.4
=43	Mexico	+7.3
105	Sudan	+7.3
67	Philippines	+7.2
9	United Kingdom	+7.2
39	South Korea	+7.1
73	Uzbekistan	+7.1
=7	Canada	+7.0

Rank / 113	Country	Score / 100
21	Poland	+7.0
80	Bangladesh	+6.9
36	Slovakia	+6.9
5	Netherlands	+6.7
93	Uganda	+6.7
58	Guatemala	+6.6
76	Nicaragua	+6.3
48	Ecuador	+6.2
=43	Russia	+6.1
=25	Chile	+5.9
100	Ethiopia	+5.8
45	Romania	+5.8
18	Costa Rica	+5.7
=41	Malaysia	+5.7
38	Bahrain	+5.6
=52	Dominican Rep.	+5.5
16	Czech Republic	+5.4
56	El Salvador	+5.4
1	Finland	+5.3
34	Hungary	+5.3
=14	New Zealand	+5.2
=68	India	+5.1
11	Switzerland	+5.0
63	Indonesia	+4.8
2	Ireland	+4.8
31	Greece	+4.7
88	Rwanda	+4.7
28	Singapore	+4.7
22	Australia	+4.6
70	Paraguay	+4.6
59	South Africa	+4.6
=64	Thailand	+4.6
=14	Denmark	+4.4
55	Belarus	+4.3
62	Tunisia	+4.3
97	Niger	+4.2
6	Japan	+4.1
17	Belgium	+3.9

Rank / 113	Country	Score / 100
10	Portugal	+3.9
12	Austria	+3.7
19	Germany	+3.6
94	Mozambique	+3.5
98	Togo	+3.5
4	France	+3.4
=7	Sweden	+3.4
66	Azerbaijan	+2.9
47	Jordan	+2.9
49	Turkey	+2.9
96	Cameroon	+2.8
=91	Malawi	+2.6
27	Italy	+2.5
30	Qatar	+2.5
79	Sri Lanka	+2.3
77	Egypt	+2.2
83	Ghana	+2.1
71	Ukraine	+2.1
95	Côte d'Ivoire	+1.5
54	Argentina	+1.3
51	Brazil	+1.3
13	United States	+1.3
=108	Madagascar	+1.2
87	Botswana	+0.9
101	Angola	+0.8
20	Spain	+0.8
111	Yemen	+0.1
3	Norway	-0.4
50	Kuwait	-0.5
107	Nigeria	-0.9
110	Sierra Leone	-1.0
=108	Burundi	-1.4
102	Zambia	-1.8
=64	Colombia	-2.2
106	Venezuela	-4.9
112	Haiti	-5.4
113	Syria	-10.5

# Appendix II: Methodology

The Global Food Security Index (GFSI) considers food affordability, availability, quality and safety, and sustainability and adaptation across 113 countries. The index is a dynamic quantitative and qualitative benchmarking model constructed from 68 unique indicators that measure the drivers of food security across both developing and developed countries.

The 2022 edition of the GFSI incorporates 14 new indicators to reflect the global nature and interconnectedness of the food system and to highlight the importance of “first mile” and farm-level metrics in determining food security for populations. The focus on the first mile, (the segment of agriculture that includes production and links farmers to the nearest market, allowing them to operate efficiently and profitably to sell the goods that they produce) is critical, as the path to enhancing food security requires concerted efforts across the value chain. Some of the new measures reflect the support available to farmers, including their access to extension services as well as community organisations like co-operatives, and whether female farmers are empowered.

The Economist Impact team adjusted the Availability pillar to start at food production, capturing more farmer-focused measures such as access to agricultural inputs. This includes moving access to finance and financial products from the Affordability pillar to the “availability” pillar, as these measures are related to farming. Government

commitment to innovative technologies and a new composite indicator for on-farm infrastructure have been added to the Availability pillar to reflect more accurately what is happening on the fields, in addition to in the supply chain.

Reflecting a global impetus to move to sustainable food systems and adapt to growing climate shocks, the GFSI’s fourth pillar, previously called Natural Resources and Resilience, has been renamed Sustainability and Adaptation. Reflecting how important biodiversity is to the agricultural sector, soil health has been added to help measure the health of the land and assess land degradation, while new indicators for climate finance flows, environmental accounting implementation and sustainable agriculture have been added to track political commitment to adaptation. In addition, a measure of pest infestation and disease has been added as part of a new composite indicator, disaster risk management, as a way of including mitigation policies.

Other changes in the 2022 framework include updating indicators to rely on more up-to-date data sources, creating more challenging standards for existing qualitative metrics and adjusting weights (after consultation with our expert panel) to reflect the realities of the current global food system.

Detailed information on the changes to the pillars and indicators included in the 2022 GFSI are as follows:

## 1. Affordability

The Economist Impact team has developed new composite indicator 1.4) Agricultural trade and added 1.4.2) Trade freedom to measure agricultural trade more comprehensively. Previously, 1.4) Agricultural import tariffs was a standalone indicator. In another move designed to measure agricultural trade more comprehensively, we have added a new composite indicator to include both 1.4.1) Agricultural import tariffs) and 1.4.2) Trade freedom as sub-indicators.

We have removed composite indicator 1.6) Market access and agricultural financial services and moved three sub-indicators (Access to finance and financial products for farmers, Access to diversified financial products, and Access to market data and mobile banking) to the “availability” pillar under 2.1) Access to agricultural inputs and 2.3) On-farm infrastructure.

## 2. Availability

We have added a new composite indicator 2.1) Access to agricultural inputs to capture more farmer-focused measures on access to agricultural inputs. We have also:

- Moved 2.1.1) Access to finance and financial products for farmers from Affordability (deleted composite indicator “Market access and agricultural financial services”), as this measure is farmer-related.
- Moved 2.1.2) Access to diversified financial products from Affordability (deleted composite indicator “Market access and agricultural financial services”), as this measure is farmer-related.
- Added 2.1.3) Producer prices, to measure farmers’ financial wellbeing more comprehensively, through the prices that they receive for the resources that they produce.
- Added 2.1.4) Access to extension services. Experts recommended adding a measure on farmers’ access to extension services, which play an important role in boosting agricultural productivity and improving farmers’ livelihoods.
- Added 2.1.5) Community organisations. Experts recommended adding a measure on government support for community organisations, such as professionally run farm-based organisations and farmer companies or co-operatives, which are key enablers of farmer well-being.
- Added 2.1.6) Empowering women farmers. Experts recommended adding a measure on empowering women farmers, who are key players in the agricultural sector but often lack access to agricultural inputs.
- Added 2.2.3) Commitment to innovative technologies to 2.2) Agricultural research & development to measure how committed governments are to promoting innovative agricultural technology adoption and use by producers.
- Removed composite indicator 2.3) Agriculture infrastructure and moved sub-indicators (Crop storage facilities; Irrigation infrastructure; Road infrastructure; and air, port and rail infrastructure) into two new composite indicators: 2.3) Farm infrastructure and 2.6) Supply-chain infrastructure.
- Added new composite indicator 2.3) Farm infrastructure to capture infrastructure on farms (versus in the supply chain) more accurately.
- Moved 2.3.1) Crop storage facilities from deleted composite indicator Agricultural infrastructure.
- Moved 2.3.2) Irrigation infrastructure from deleted composite indicator Agricultural infrastructure.

- Moved 2.3.3) Access to market data and mobile banking from Affordability (removed composite indicator Market access and agricultural financial services).
- Moved 2.4) Volatility of agricultural production and 2.5) Food loss to after 2.3) On-farm infrastructure.
- Added new composite indicator 2.6) Supply-chain infrastructure to capture infrastructure in the supply chain (versus on-farm) more accurately.
- Added 2.6.1) Planning and logistics to assess how well countries are able to move food from areas of excess to areas of need.
- Moved 2.6.2) Road infrastructure from deleted composite indicator Agricultural infrastructure.
- Moved 2.6.3) Air, port and rail infrastructure from deleted composite indicator Agricultural infrastructure.
- Moved 2.7) Sufficiency of supply from the beginning of the Availability pillar to after 2.6) Supply chain infrastructure.

### 3. Quality and Safety

We have added new composite indicator 3.1) Dietary diversity and sub-indicator 3.1.2) Sugar consumption to more comprehensively measure dietary diversity, and in particular the consumption of sugar, as households increasingly migrate to urban areas. Previously, indicator 3.1) was a standalone indicator, but experts recommended looking at the consumption of snack foods or sugar.

We have also added 3.5.1) Relevant food safety legislation to 3.5) Food safety to measure how responsive food safety mechanisms are to current and future-facing food safety issues.

### 4. Sustainability and Adaptation

We have renamed this pillar (previously called Natural Resources and Resilience) Sustainability and Adaptation. In terms of other changes to the pillar, we have also:

- Added 4.3.4) Soil organic content to 4.3) Land, to more comprehensively measure the health of land and how land degradation might impact agriculture. Soil organic content is critical to the ecosystems of goods and services associated with soils.
- Added 4.5.1) Climate finance flows to 4.5) Political commitment to adaptation, to measure how much money governments are trying to channel toward adaptation and risk mitigation.
- Added 4.5.2) Environmental accounting implementation to 4.5) Political commitment to adaptation, to assess how countries are improving national planning for national resource management and monitoring.
- Added 4.5.6) Sustainable agriculture to 4.5) Political commitment to adaptation, to assess commitment to sustainable agricultural practices, which can improve country resilience to climate and natural resource risk.
- Added new composite indicator 4.6) Disaster risk management and sub-indicator 4.6.1) Pest infestation and disease mitigation. Previously, indicator 4.6 was a standalone indicator. To incorporate a measure of mitigation policies for pest infestation and disease, Economist Impact changed indicator 4.6 to a composite indicator to include both 4.6.2) Risk management coordination (an existing indicator) and the new 4.6.1) Pest infestation and disease mitigation as sub-indicators.
- Removed 4.5) Sensitivity, including 4.5.1) Food import dependence and 4.5.2) Dependence on natural capital, as we incorporated trade-related



measurements in the Affordability pillar to reflect the changing nature and interconnectedness of the global food system.

- Removed 4.7) Demographic stress, including 4.7.1) Projected population growth and 4.7.2) Urban absorption capacity, based on experts' recommendations that population growth and urban absorption capacity are not necessarily positive or negative drivers of food security.

## Expert panel participants

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

### The first iteration—2012 GFSI

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

#### **Ademola Braimoh**

Senior Natural Resources Management Specialist, World Bank

#### **Margaret Enis**

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

#### **Craig Gundersen**

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

**Eileen Kennedy**

Professor, Friedman School of Nutrition Science and Policy, Tufts University

**Samarendu Mohanty**

Senior Economist & Head, International Rice Research Institute

**Prabhu Pingali**

Professor & Director, Tata-Cornell Agriculture & Nutrition Institute, Cornell University

**Pedro Sanchez**

Research Professor, Tropical Soils, University of Florida.

**David Spielman**

Senior Research Fellow, International Food Policy Research Institute

**Robert Thompson**

Senior Fellow, Chicago Council on Global Affairs

**Patrick Westhoff**

Director, Food and Agricultural Policy Research Institute

**Howard Cowden**

Professor of Agricultural and Applied Economics, University of Missouri.

**The sixth iteration – 2017 GFSI**

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

**Joe Glauber**

Senior Research Fellow, International Food Policy Research Institute

**Elise Golan**

Director, Sustainable Development, US Department of Agriculture

**Susanna Hecht**

Professor of Urban Planning, University of California, Los Angeles

**Karin Kemper**

Global Director, Environment, Natural Resources and Blue Economy Global Practice, World Bank

**Catie Lee**

Senior Marketing Manager, GreenLight Biosciences

**Shaun Martin**

Vice-President, Ecological and Social Resilience at World Wildlife Fund

**Dawn Rittenhouse**

Director, Sustainable Development, DuPont

**Allison Thomson**

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

**Sonja Vermeulen**

Director of Programmes, CGIAR System Management Organisation

**Sara Walker**

Senior Manager, Water Quality and Agriculture, World Resources Institute

**The ninth iteration – 2020 GFSI**

As part of the review process in 2020, Economist Impact consulted several new experts, along with a few from past panels, to ensure that the index remains a powerful tool in highlighting the major challenges for food security worldwide. The following additional experts were consulted during this review:

**Boaz Keizire**

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

**Paul Winters**

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

**Lauren Phillips**

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

**Abdul Sattar**

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

**Akmal Siddiq**

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

**The 11th (and most recent) iteration – 2022 GFSI**

Economist Impact continues to review the framework and methodology annually to strengthen each iteration. For the 11th iteration of the GFSI, Economist Impact convened an advisory panel of 11 experts in March 2022 to review and critically assess the GFSI framework, suggest modifications to the index in the form of adding or subtracting indicators, and discuss alternatives for indicators with data constraints. The following experts participated in the meeting:

**Tilahun Amede**

Head of Resilience, Climate & Soil Fertility, Alliance for a Green Revolution in Africa (AGRA)

**Rob Bertram**

Chief Scientist, Bureau for Resilience and Food Security, USAID

**Jade Dyson**

Director, GAFTA: The Grain and Feed Trade Association (GAFTA)

**Nicoline de Haan**

Director, CGIAR Generating Evidence and New Directions for Equitable Results (GENDER) Platform

**Sheryl Hendriks**

Head of Department and Professor of Food Security, Department of Agricultural Economics, University of Pretoria, South Africa

**Narayan Iyer**

Senior Natural Resources and Agriculture Specialist, Asian Development Bank (ADB)

**Eileen Kennedy**

Professor, Friedman School of Nutrition Science and Policy, Tufts University

**Lloyd Le Page**

Managing Director, Kincannon & Reed Global

**Lauren Phillips**

Senior Technical Specialist on Policy, International Fund for Agricultural Development (IFAD)

**Rob Vos**

Director Markets, Trade and Institutions, International Food Policy Research Institute (IFPRI)

**Stanley Wood**

Senior Program Officer, Agricultural Development, Bill & Melinda Gates Foundation

## 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 2022 index are:

Asia Pacific	Europe	Latin America	North America	Middle East and North Africa	Sub-Saharan Africa
Australia	Austria	Argentina	Canada	Algeria	Angola
Azerbaijan	Belarus	Bolivia	United States	Bahrain	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 pillar and indicator in the workbook 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 the 11 members of the 2022 expert panel. The 2022 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 pillars 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:

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

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 2022 edition, upper and lower threshold values are specified for all series (the data values that 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 2012-22 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 2022 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.

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 EIU, 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.

Indicator	Primary source(s)	Indicator definitions and construction	Indicator rationale	
<b>1) Affordability</b>				
1.1	Change in average food costs	UN Food and Agriculture Organisation (FAO)	A measure of the change in average food costs, as captured through the Food CPI which tracks changes in the price of the average basket of food goods since 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 (UNDP)	A measure of individual income (GNI per capita at 2011 PPP) adjusted for levels of inequality.	Average income levels can determine the affordability of food.
<b>1.4</b>	<b>Agricultural trade</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator examining linkages between countries.</b>
1.4.1	Agricultural import tariffs	World Trade Organisation (WTO)	A measure of the average most-favoured nation (MFN) tariff applied on all agricultural imports.	Agricultural tariffs can increase the cost of food imports, and therefore food costs for consumers.
1.4.2	Trade freedom	Heritage Index of Freedom	A measure of trade freedom, a composite metric that measures the extent of tariff and non-tariff barriers affecting the import and export of goods and services. The Heritage Index of Freedom calculates the trade freedom score based on two inputs: trade-weighted average tariff rate and non-tariff barriers.	Free trade agreements can allow for more diversified sources of food.

Indicator	Primary source(s)	Indicator definitions and construction	Indicator rationale	
<b>1.5</b>	<b>Food safety net programmes</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator assessing the presence and nature of food safety-net programmes.</b>
1.5.1	Presence of food safety-net programmes	Qualitative scoring by Economist Impact analysts	Are food safety-net programmes present in the country and able to reach the populations who need support?	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	Is there evidence that the food safety-net programmes have sufficient 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	Do the food safety-net programmes have national coverage and include a broad 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 program	Qualitative scoring by Economist Impact analysts	Are the food safety-net programmes operated by the government and not-dependent on external operational or funding support?	Food safety-net programmes operated by the national government are more sustainable.

<b>2) Availability</b>				
2.1	Access to agricultural inputs	Economist Impact calculation	Composite indicator	A composite indicator that measures resources and inputs for farmers.
2.1.1	Access to finance and financial products for farmers	Qualitative scoring by Economist Impact analysts	Do farmers have access to basic, affordable financial services (savings and credit)?	Access to savings and credit improves farmer productivity and the ability of farmers to provide for their own families.
2.1.2	Access to diversified financial products	Qualitative scoring by Economist Impact analysts	Do farmers have access to diversified financial services beyond savings and credit?	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.
2.1.3	Agriculture producer prices	UN Food and Agriculture Organisation (FAO)	A measure (PPI) of the average annual change over time in the selling prices received by farmers (prices at the farm-gate or at the first point of sale).	Higher agriculture producer prices, measured by the producer price index (PPI), can indicate that producers are getting more money for the crops that they are producing.
2.1.4	Access to extension services	Qualitative scoring by Economist Impact analysts	Do farmers have access to agricultural extension or advisory services?	Agricultural extension plays an important role in boosting agricultural productivity, increasing food security and improving rural livelihoods, and helps rural producers meet new challenges confronting agriculture.
2.1.5	Community organisations	Qualitative scoring by Economist Impact analysts	Do farmers have access to community organisations (for example, producers' associations, co-operatives, unions, and federations)?	Community organisations, which deliver services to farmers, facilitate their access to markets, and empower farmers to engage in policy dialogue, are key enablers of farmer wellbeing.
2.1.6	Empowering women farmers	Qualitative scoring by Economist Impact analysts	Does the country have a national policy or strategy focused on supporting women farmers or improving women's access to agricultural inputs?	Women are key players in the agricultural sector, but lack of access to agricultural inputs, including resources, production decision-making, and income, limit their inclusion and agency in the sector.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
<b>2.2</b>	<b>Agricultural research &amp; development</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures agricultural research and development.</b>
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 UN Sustainable Development Goals Target 2.a on public investment in agriculture. This is a proxy indicator for investment in agricultural research and development.
2.2.2	Access to agricultural technology, education and resources	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 vs staple crop yields, as this shows an investment in national-level food security and production, rather than export, staple crops (this also factors in micronutrient availability vs available calories).
2.2.3	Commitment to innovative technologies	Qualitative scoring by Economist Impact analysts	Does the country have a policy framework that facilitates development of innovative agricultural technology?	Innovative technologies can create more sustainable farming systems and help farmers increase their productivity.
<b>2.3</b>	<b>Farm infrastructure</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures ability to store crops.</b>
2.3.1	Crop storage facilities	Qualitative scoring by Economist Impact analysts	Is there evidence of government, multilateral/donor or private-sector funding to improve crop storage in 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	Irrigation infrastructure	UN Food and Agriculture Organisation (FAO)	A measure of the percentage of cultivated agricultural area that is equipped for irrigation.	Investments to improve or expand crop storage facilities are critical for ensuring that there is a sufficient food supply.
2.3.3	Access to market data and mobile banking	International Telecommunication Union (ITU)	A measure of mobile subscribers per 100 inhabitants.	Mobile phone technology is critical for farmers to access up-to-date market information and agricultural extension services. Furthermore, farmers and food-insecure populations benefit from access to inclusive financial services, such as through mobile banking.
2.4	Volatility of agricultural production	UN Food and Agriculture Organisation (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	Food loss	UN Food and Agriculture Organisation (FAO)	A measure of post-harvest and pre-consumer food loss as a ratio of the domestic supply (production, net imports and stock changes) of crops, livestock and fish commodities (in tonnes).	Higher levels of food loss reduce the overall food availability.
<b>2.6</b>	<b>Supply chain infrastructure</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures the ability to transport crops to market.</b>
2.6.1	Planning and logistics	World Bank (Logistics Performance Index)	A measure of national transport and logistics performance (Logistics Performance Index) using six indicators related to main inputs to the supply chain and supply-chain performance outcomes.	Transport and logistics strategies are key for moving food from areas of excess to areas of need.



Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
2.6.2	Road infrastructure	EIU Risk Briefing	What is the quality of the national road infrastructure?	Regardless of the country's geography and infrastructure, road infrastructure plays a crucial role in food transport.
2.6.3	Air, port and rail infrastructure	EIU Risk Briefing	What is the quality of the national port, air and rail infrastructure?	Depending on the country's geography and infrastructure, port, air and rail infrastructure play a crucial role in food transport.
<b>2.7</b>	<b>Sufficiency of supply</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures the availability of food.</b>
2.7.1	Food supply adequacy	UN Food and Agriculture Organisation (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.
2.7.2	Dependency on chronic food aid	OECD	A measure of whether a country is a recipient of chronic food aid by assessing change in average emergency food aid per capita received over the past five years.	Consistent, high levels of food aid indicates that the available food supply is insufficient to meet the population needs.
<b>2.8</b>	<b>Political and social barriers to access</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures political and social barriers to access.</b>
2.8.1	Armed conflict	EIU Risk Briefing	An assessment of the risk of armed conflict.	Armed conflict is a critical driver of food insecurity, as it disrupts food production, access to markets and livelihoods.
2.8.2	Political stability risk	EIU Risk Briefing	An assessment of general political instability.	Political instability has the potential to disrupt access to food, for example through transport blockages or reduced food aid commitments.
2.8.3	Corruption	EIU Risk Briefing	An assessment of the risk and pervasiveness of corruption in a country.	Corruption can impact food availability through distortions and inefficiencies in the use of natural resources, as well as bottleneck inefficiencies in food distribution.
2.8.4	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.
<b>2.9</b>	<b>Food security and access policy commitments</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures food security and access policy commitments.</b>
2.9.1	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.
2.9.2	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 or ministry assesses whether the government has invested in, can be held accountable for, and is taking a co-ordinated approach to achieving food security.

Indicator	Primary source(s)	Indicator definitions and construction	Indicator rationale	
<b>3) Quality and Safety</b>				
<b>3.1</b>	<b>Dietary diversity</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures dietary diversity.</b>
3.1.1	Share of non-starchy foods	UN Food and Agriculture Organisation (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.
3.1.2	Share of sugar consumption	OECD	A measure of the share of sugars [sugar (raw equivalent), sweeteners other, honey, sugar beet, sugar cane, and sugar non-centrifugal] in total dietary energy consumption.	Higher amounts of sugar intake in the population can indicate higher consumption of sugar sweetened beverages (SSB) and non-essential energy dense foods which are low in nutritional value and increase the risk of negative health outcomes.
<b>3.2</b>	<b>Nutritional standards</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures government commitment to increasing nutritional standards.</b>
3.2.1	National dietary guidelines	Qualitative scoring by Economist Impact analysts	Has the government published and implemented dietary guidelines? Does it have plans in place for their timely re-evaluation?	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.
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 and nutrition-related deficiencies.	Monitoring the nutritional status enables the government to identify current nutritional deficiencies and deploy resources where needed.
<b>3.3</b>	<b>Micronutrient availability</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures the availability of micronutrients in the food supply.</b>
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.

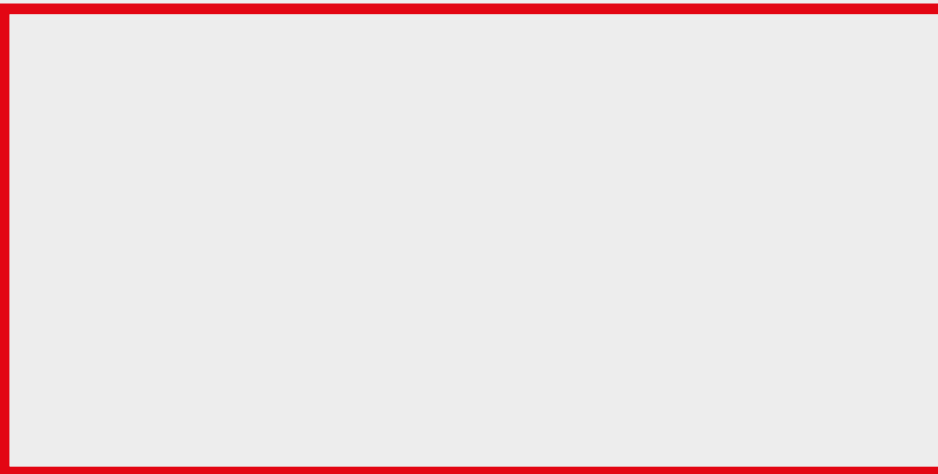
Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
3.5.1	Food safety mechanisms	WHO, Country-reported data	A measure of the efficacy of food safety mechanisms, as captured by a WHO-assigned score based on a 20+-question country self-assessment on food safety, including 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.
3.4	Protein quality	Economist Impact calculation based on data from the FAO, the WHO and the USDA Nutrient Database	<b>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.</b>	<b>Protein supply alone is an insufficient assessment of nutrition; there are nine essential amino acids which humans cannot synthesise and must consume through dietary sources.</b>
3.5	Food safety	Economist Impact calculation	Composite indicator	<b>A composite indicator that measures the enabling environment for food safety.</b>
3.5.1	Relevant food safety legislation	Qualitative scoring by Economist Impact analysts	Has the country enacted food safety legislation, and has the legislation been updated in the past 5-10 years?	Timely updates to food safety legislation ensures that food safety mechanisms remain responsive to current and future-facing food safety issues.
3.5.2	Food safety mechanisms	World Health Organisation (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.
3.5.3	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.
3.5.4	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	
<b>4) Sustainability and adaptation</b>				
<b>4.1</b>	<b>Exposure</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures exposure to the impacts of climate change.</b>
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 (1960-1990) to the future projection (2040-2070), 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 to drought.	Susceptibility to drought can lead to unpredictable crop loss and declines in food supply in certain years.
4.1.3	Flooding	Notre Dame Global Adaptation Initiative (ND-GAIN)	A measure of extreme precipitation under climate change, a risk factor for flood hazard. The projected change is the percentage change of the flood hazard from the baseline projection (1960-1990) to the future projection (2040-2070), 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	Notre Dame Global Adaptation Initiative (ND-GAIN)	A measure of projected sea level rise. For landlocked countries, an estimate is provided based on the country's major coastal trading partners.	Sea level rise can lead to increased unpredictable crop loss and soil salinity, as well as declines in food supply in certain years.
<b>4.2</b>	<b>Water</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures the health of fresh-water resources and how depletion might impact agriculture.</b>
4.2.1	Agricultural water risk – quantity	World Resources Institute 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	World Resources Institute 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.
<b>4.3</b>	<b>Land</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures the health of land, and how land degradation might impact agriculture.</b>
4.3.1	Land degradation	UN	A measure of the proportion of land that is degraded over total land area	Land degradation may impact the quality and availability of soil and arable land.
4.3.2	Grassland	UN Food and Agriculture Organisation (FAO)	A measure of greenhouse gas emissions from the drainage of organic soils (e.g. peatlands) under grassland (Net emissions / removals of CO <sub>2</sub> , 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.

Indicator		Primary source(s)	Indicator definitions and construction	Indicator rationale
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 ecosystem changes may impact agricultural productivity.
4.3.4	Soil organic content	FAO	A measure of organic carbon present in soil (tonnes per hectare)	Soil organic content is a good indicator of soil and land quality. High levels of organic carbon stabilise soil structure, reduces erosion, improves soil fertility and enhances its water-holding capacity.
<b>4.4</b>	<b>Oceans, rivers and lakes</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures the health of oceans, a crucial source of protein for many populations.</b>
4.4.1	Eutrophication	World Resources Institute	What is the potential for coastal eutrophication?	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.
<b>4.5</b>	<b>Political commitment to adaptation</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>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.</b>
4.5.1	Climate finance flows	OECD	A measure of climate mitigation- and adaptation-related official development assistance allocated to recipient countries.	Financial commitments to climate-related development can improve a country's climate adaptation and risk mitigation.
4.5.2	Environmental-economic accounting implementation	UN	An assessment on the status and implementation of the SEEA (System of environmental-economic accounting) in three progressive stages.	Commitment to environmental-economic accounting implementation can improve national planning for natural resource monitoring and management.
4.5.3	Early-warning measures / climate-smart Agriculture	CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)	Has the country committed to developing early-warning measures for the agricultural sector and invested in climate-smart agricultural practices?	Commitments to early-warning measures for agriculture can improve country resilience for climate and natural resource risks.
4.5.4	Commitment to managing exposure	CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)	An assessment of whether countries are committed to addressing agriculture-related climate exposure and natural resource management under the Nationally Determined Contributions (NDC). NDC mitigation measures include croplands, grasslands, forest management, degraded lands, coasts and peatlands. NDC adaptation measures include water management, soil, fisheries and aquaculture, and agroforestry.	National commitments to addressing exposure-related factors are a sign of political will and investments to mitigate these risks to agriculture.

Indicator	Primary source(s)	Indicator definitions and construction	Indicator rationale	
4.5.5	National agricultural adaptation policy	Qualitative scoring by Economist Impact analysts based on WHO, FAO and national health ministry documents	Does the country have a current national climate change strategy which covers adaptation for agriculture?	Commitments to risk management practices for agriculture can improve country resilience for climate and natural resource risks.
4.5.6	Sustainable agriculture	Qualitative scoring by Economist Impact analysts	Is there a national policy that promotes sustainable agricultural practices? Does the government provide incentives for sustainable agricultural practices?	Commitments to sustainable agricultural practices can improve country resilience for climate and natural resource risk.
<b>4.6</b>	<b>Disaster risk management</b>	<b>Economist Impact calculation</b>	<b>Composite indicator</b>	<b>A composite indicator that measures disaster risk management.</b>
4.6.1	Pest infestation and disease mitigation	Qualitative scoring by Economist Impact analysts	Is there a national policy in place to mitigate the risk of pest infestation and infections from diseases on production? The national policy can include measures such as use of technology for monitoring pests, suggested crop selection and cropping techniques, or use of natural pesticides.	Measures to mitigate the risk of pest infestation and infections by diseases can help reduce the impact of these events.
4.6.2	Risk management coordination	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.

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