
Appetite for change: food, ESG and the nexus of nature

Part IV: The quest for food security

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1

Executive summary

- Recent events, Russia’s invasion of Ukraine foremost among them, have propelled food security back toward the top of international agendas.
- Yet the reality is that the issue has always been hugely significant, with previous attempts to address the problem failing to deliver a truly lasting solution.
- Today food security is just one of many interconnected crises that highlight the urgent need to disrupt a global food system that is no longer fit for purpose.
- Despite the scale of the challenge amid a “perfect storm”, there is growing reason to believe the quest to feed all of humanity can at last be achieved.
- The pace of technological advances – as evidenced, for example, by the rise and spread of agtech – offers the promise of continued innovation in this sphere.
- As shown by the success of many leading countries in the Global Food Security Index, the power of public-private partnerships is also likely to be crucial.
- Investors have a major role to play in both financing the necessary transition and ensuring it takes account of the bigger picture – that is, the planet as a whole.

2

Introduction



The burgeoning expectation is that this arena will make an enduring difference on a vast scale.

More than a quarter of a century has passed since the Food and Agriculture Organization (FAO) of the United Nations (UN) published the Rome Declaration on Food Security. A landmark pledge to dramatically reduce undernourishment around the world, the document was notable for officially defining the concept of food security for the first time.

According to the declaration’s opening lines, food security is achieved “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”. “In this regard,” the FAO added, “concerted action at all levels is required.”¹

Today the declaration serves as a timely reminder that food security is not a challenge exclusive to the 21st century. Recent events – most obviously Russia’s invasion of Ukraine² – may have thrown it into uncommonly sharp focus, but the issue has invariably existed in some form; in tandem, the “concerted action” of which the FAO spoke in 1996 has always been necessary. More than the phenomenon itself, it is wider awareness of food security that has waxed and waned over time.

Now, thanks to what UN Secretary-General António Guterres has called a “perfect storm”,³ both the seriousness of the problem and the degree of attention it is attracting are unusually high. So, too, is appreciation of the fact that the solution is likely to lie in radically disrupting a food system that is no longer fit for purpose.

Previous papers in this series have explained in detail why the status quo has become unsustainable. We have highlighted how a heavily industrialized food system contributes to many of the gravest threats facing the planet and its inhabitants;⁴ we have examined the “normalization of deviance” in production and consumption;⁵ and we have assessed the capacity of a technology-driven Ever-Green Revolution to bring about positive, lasting change.⁶

Here we explore food security’s position within this narrative. We consider previous attempts to tackle the scourge of hunger; we look at current efforts and why they may increasingly offer grounds for optimism; and we reflect on the role of the investment community in at last fulfilling the fundamental goal of feeding all of humanity.

As observed in another Invesco paper, the transformation of the global food system is likely to represent one of the major investment themes of the years and decades to come.⁷ At last accomplishing long-term food security will be the crux of the required transition.

3

From population principle to perfect storm



Fears over hunger and resource scarcity have seldom intensified without triggering some kind of meaningful response in the post-Malthus age.

3.1. Revolutionary thinking

At the end of the 18th century, in *An Essay on the Principle of Population*, Thomas Malthus famously warned of the human race's "premature death".⁸ His prediction that population growth must inevitably outstrip food production has cast a shadow over the quest for food security ever since.

As a result, fears over hunger and resource scarcity have seldom intensified without triggering a meaningful response in the post-Malthus age. Today, not least from an investment perspective, the nature and impact of those responses must be understood in order to best shape the way ahead.

The most significant "Malthus moment" of the 1900s arguably came in the wake of World War II. Coupled with advances in medicine, the post-conflict baby boom led to marked population growth at a time when international relations were in flux, developed nations were reverting to a peacetime economy and newly independent countries were assuming greater control over their agricultural outputs.

Amid the ensuing struggle for self-sufficiency, the Green Revolution emerged as a game-changing source of food security. The extraordinary progress it was able to stimulate was first witnessed in Mexico, which went from importing half its wheat to exporting around 500,000 tons' worth in the space of just 20 years.⁹

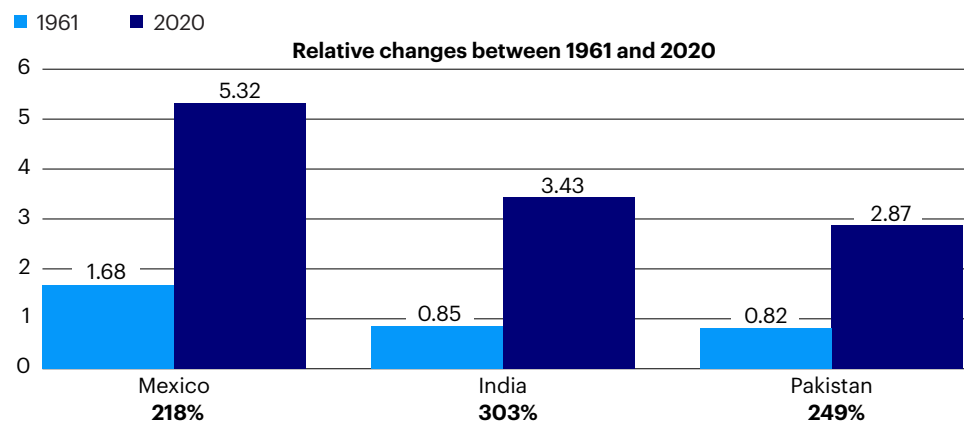
Underpinned by novel crop varieties capable of resisting disease and generating enormous yields, the revolution spread during the 1950s, 1960s and 1970s. It helped Bangladesh, India and Pakistan stave off mass famine; it doubled or even tripled yields in South-East Asia, Africa and the Middle East; and it earned its principal architect, plant pathologist and geneticist Norman Borlaug, the 1970 Nobel Peace Prize.

Describing the impact of his work as "spectacular", Borlaug suggested universal food security – which he framed as "adequate food for all mankind" – should be seen as "the first essential component of social justice". "If you desire peace," he said in his Nobel Lecture, "cultivate justice. But at the same time cultivate the fields to produce more bread, otherwise there will be no peace."¹⁰

Unfortunately, as discussed in the third paper in this series, the Green Revolution eventually brought unintended consequences.¹¹ These included an overreliance on fertilizers, pesticides, irrigation and other agricultural practices now readily associated with environmental damage. Perhaps more importantly, the food security it apparently delivered did not last.

A growth industry

The Green Revolution that commenced after World War II drove tremendous rises in crop yields in many parts of the world. The chart below shows how wheat yields (as measured in tons per hectare) increased in Mexico, which acted as the revolution's cradle, and in India and Pakistan, both of which avoided mass famine as a result.



Source: Our World in Data: "Crop yields", June 2021

3.2. A losing battle

Dale Hathaway was the founding Director General of the International Food Policy and Research Institute. In 1975, a few months after the inaugural World Food Conference was dominated by claims that millions of people faced starvation, he posited that developed and developing nations alike had become “complacent” about food supply.

Hathaway believed a “‘surplus’ psychology” had gradually taken hold. Such an outlook might have been justified until the early 1970s, he said, but continued food security – “the world food situation”, as he termed it – could not be taken for granted.¹²

Twenty-one years later, at the World Food Summit, Hathaway’s cautionary tone rang especially true. The Rome Declaration on Food Security was launched against a backdrop of more than 800 million people suffering from chronic undernourishment.¹³

The declaration sought to halve this number by 2015;¹⁴ the UN Millennium Declaration, published in 2000, instead aimed to halve the prevalence of chronically undernourished people by the same date.¹⁵ Both pledges used 1990 as a baseline, meaning the former would need to save more than 400 million people from hunger and the latter more than 500 million.¹⁶

It soon became clear that neither goal would be reached. Almost 850 million people were still classed as undernourished in 2005, and by 2007 the total stood at 923 million – around 80 million higher than in 1990.¹⁷

In 2008, with food prices rocketing, the FAO effectively conceded defeat. “World hunger is increasing,” it said. “Long-term estimates show that some countries were well on track toward reaching the World Food Summit and Millennium Development Goal targets before the period of high food prices; however, even these countries may have suffered setbacks.”¹⁸

The food crisis of 2007 and 2008 went on to rank as the worst since the mid-1970s, when Hathaway had offered his thoughts on “the world food situation”. The FAO spoke of a “global challenge requiring a global response” from the public and private sectors.¹⁹ Prices fell sharply in late 2008, but in 2010 they returned to and then surpassed previous levels. The dream of universal food security appeared as elusive as ever.



The food crisis of 2007 and 2008 went on to rank as the worst since the mid-1970s. The FAO spoke of a 'global challenge requiring a global response'.

The fight to reduce undernourishment

Both the Rome Declaration on Food Security and the UN Millennium Declaration contained ambitious pledges to tackle undernourishment by 2015. By the mid-2000s it was obvious that neither target would be met, and since then the fight to reduce the number and prevalence of chronically undernourished people worldwide has continued to prove difficult. The chart below shows the prevalence of undernourishment, expressed as a percentage of population, in regions worldwide between 2005 and 2020.

	2005	2010	2015	2016	2017	2018	2019	2020*
World	12.4	9.2	8.3	8.3	8.1	8.3	8.4	9.9
Africa	21.3	18.0	16.9	17.5	17.1	17.8	18.0	21.0
Northern Africa	8.5	7.3	6.1	6.2	6.5	6.4	6.4	7.1
Sub-Saharan Africa	24.6	20.6	19.4	20.1	19.5	20.4	20.6	24.1
Eastern Africa	33	28.4	24.8	25.6	24.9	25.9	25.6	28.1
Middle Africa	36.8	28.9	28.7	29.6	28.4	29.4	30.3	31.8
Southern Africa	5	6.2	7.5	7.9	7.3	7.6	7.6	10.1
Western Africa	14.2	11.3	11.5	11.9	11.8	12.5	12.9	18.7
Asia	13.9	9.5	8.3	8.0	7.8	7.8	7.9	9.0
Central Asia	10.6	4.4	2.9	3.2	3.2	3.1	3.0	3.4
Eastern Asia	6.8	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
South-eastern Asia	17.3	11.6	8.3	7.8	7.4	6.9	7.0	7.3
Southern Asia	20.5	15.6	14.1	13.2	13.0	13.1	13.3	15.8
Western Asia	9	9.1	14.3	15.0	14.5	14.4	14.4	15.1
Western Asia and Northern Africa	8.8	8.2	10.5	10.9	10.7	10.6	10.7	11.3
Latin America and the Caribbean	9.3	6.9	5.8	6.8	6.6	6.8	7.1	9.1
Caribbean	19.2	15.9	15.2	15.4	15.3	16.1	15.8	16.1
Latin America	8.6	6.2	5.1	6.2	6.0	6.1	6.5	8.6
Central America	8.0	7.4	7.5	8.1	7.9	8.0	8.1	10.6
South America	8.8	5.7	4.2	5.4	5.2	5.4	5.8	7.8
OCEANIA	6.9	5.3	6.1	6.2	6.3	6.2	6.2	6.2
Northern America and Europe	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5

Source: Food and Agriculture Organization: The State of Food Security and Nutrition in the World 2021, 2021; * - projected values, based on the middle of the projected range

3.3. Crisis upon crisis

International policymakers adjusted their sights after the targets enshrined in the Rome and Millennium Declarations went unmet. In 2015, the year originally identified as the deadline for halving global undernourishment, “Zero hunger” was among the 17 Sustainable Development Goals unveiled by the UN.

Each SDG is geared toward 2030. The chances of seeing zero hunger in the world by then are remote, to say the least. In 2017, less than two years after the SDGs were adopted in earnest, the FAO admitted: “The current rate of progress will not be enough to eradicate hunger by 2030 and not even by 2050.”²⁰

“Rate of progress” could even be deemed a misnomer in this context. According to the Global Food Security Index, published annually by Economist Impact, losses generally outweighed gains between 2011 and 2021 – the first decade of the index’s life.²¹

Similarly, the 2021 edition of the Global Hunger Index concluded: “Progress towards zero hunger by 2030, already far too slow, is showing signs of stagnating or even being reversed.” Its findings were described as laying bare “a dire hunger situation fueled by a toxic cocktail of the climate crisis, the COVID-19 pandemic and increasingly severe and protracted violent conflicts”.²² The 2022 edition reported 44 countries with “serious” or “alarming” levels of hunger.²³

In early 2022, of course, this “dire situation” started to deteriorate further. Citing Russia’s invasion of Ukraine, supply-chain interruptions and the ongoing economic fallout from coronavirus, the World Bank warned: “Record-high food prices have triggered a global crisis that will drive millions more into extreme poverty, magnifying hunger and malnutrition.”²⁴

Published by the UN’s World Food Programme, the 2022 Report on Global Food Crises detailed “hunger on an unprecedented scale”. It estimated a record 193 million people – almost 40 million more than a year previously – to be in “crisis” in relation to food security. The authors said the findings should “jolt the world into action”²⁵ – yet 2023’s report revealed another startling rise, with more than a quarter of a billion people facing crisis.²⁶

As remarked earlier, the issue of food security has never gone away. It has simply fluctuated in severity, ascending and descending agendas accordingly. Just as it captured attention in the aftermath of war almost 80 years ago, today it is capturing attention in war’s midst. The stage is once again set for a truly meaningful response.



The World Food Programme estimated a record 193 million people to be in ‘crisis’ in relation to food security, with more than half a million facing ‘catastrophe’.

The growing crisis of food insecurity

The World Food Programme’s Report on Global Food Crises series uses a five-phase scale to categorize levels of food insecurity. As the chart below shows, the number of people worldwide categorized under phase 3 – indicative of “crisis” – has risen by more than 150 million in recent years.

2016	2017	2018	2019	2020	2021	2022
105 million	123.5 million	112.7 million	134.8 million	155.3 million	192.8 million	257.8 million

Source: World Food Programme: 2023 Global Food Crises Report, 2023

4

What next?

4.1. Innovation as a constant

The Green Revolution that followed World War II initially offered an astonishing demonstration of humanity's ability to innovate its way out of trouble. Novel thinking transformed agriculture and brought previously unimaginable levels of food security to countries around the world.

Yet the revolution did not last. Its long-term efficacy was questioned as early as the 1970s, and there can now be little doubt that the food system it did so much to define has become unsustainable. In contributing to the next revolution, investors first need to understand why Norman Borlaug's vision slowly fell apart.

How we view innovation itself may provide an answer. Broadly speaking, there are two types of innovation: incremental, which seeks to do things better, and radical, which seeks to do things not just better but differently.

The Green Revolution began with radical innovation, yet it slipped into incremental innovation over time. Many of its formative ideas endured, but their beneficial impacts did not. At best, piecemeal advances were used to embellish the status quo; at worst, they were used to perpetuate suboptimal practices and policies. Mechanization, industrialization and profitability came to be regarded as the key constants.

The revolution unfolding in agriculture today is also rooted in radical innovation. This is most obvious in the sphere of agtech – agricultural technology – as outlined in the third paper in this series.²⁷ So should we expect incrementalism to dominate further down the line, as it did in the past?

Not necessarily. The pace of technological advances today is massively beyond that of 80, 40 or even 10 years ago – enhancing the likelihood of radical innovation becoming a norm rather than remaining confined to sporadic blips. As Dale Hathaway intimated back in 1975, complacency and inertia are the enemies.

Relatedly, crisis can accelerate radical innovation. The Green Revolution proved this; so did the COVID-19 pandemic, which spurred numerous breakthroughs – vaccines and remote working foremost among them. In no small part because of mounting concerns over food security, the food system has rarely been more ready for sweeping disruption: now is the time for “the gale of creative destruction”²⁸ to blow – and, crucially, to keep blowing.

“

The pace of technological advances today enhances the likelihood of radical innovation becoming a norm rather than remaining confined to sporadic blips.

Case study: United Arab Emirates

The Middle East might not immediately spring to mind when investors think of the leading lights in developing sustainable agriculture and augmenting food security. Yet the region offers a compelling illustration of the links between crisis, innovation and long-term resilience.

In the United Arab Emirates (UAE), for instance, rapid growth in agtech has sprung from historical realities such as diminishing groundwater reserves, arid conditions and low reuse of water. High levels of food imports²⁹ and food waste³⁰ have further underlined the need for dramatic change.

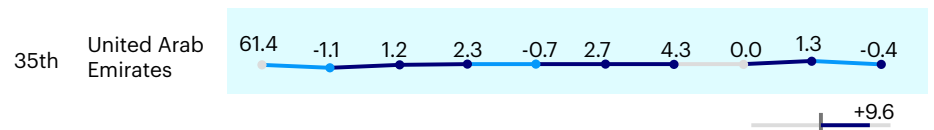
Disruption of the established system began some years ago. It included the founding in 1998 of the International Center for Biosaline Agriculture (ICBA), which specializes in resource-efficient crops and technologies suitable for areas affected by salinity, water scarcity and drought.³¹

In 2018 the UAE government introduced its National Food Security Strategy 2051, whose aims include “enabling sustainable food production through the use of modern technologies”.³² Three years later, to bolster this initiative, Food Tech Valley was launched in Dubai.³³

Food Tech Valley’s ultimate goal is to triple food production in the UAE. Its work encompasses themes such as food innovation, logistics and agtech – especially vertical farming – while its remit includes incubating promising ideas and supporting entrepreneurs and start-ups.

In a clear sign of its importance, Sheikh Mohammed Bin Rashid Al Maktoum, the UAE’s Vice President and Prime Minister, officially opened the facility. He said it would “create a nurturing environment for agribusinesses to develop new farming technologies and enhance our future food security”.³⁴

The UAE says it wants to top the Global Food Security Index by 2051. It placed 35th in 2021, scoring 71 out of 100; its level of improvement over the preceding decade, as charted below, was bettered only by Algeria, Oman and Tanzania, all of which ranked lower overall. In 2022 it placed 23rd, scoring 75.2.³⁵



Source: Economist Impact: Global Food Security Index, 2021; figures show annual rises and declines in GFSI score between 2012 and 2021, plus overall rise

4.2. The power of public-private collaboration

As noted in section 3.2, the FAO demanded a “global response” to the food crisis of 2007 and 2008. It called for “a comprehensive twin-track approach” involving “governments, donors, the United Nations, non-governmental organizations, civil society and the private sector”.³⁶

This was by no means a groundbreaking idea. Multi-stakeholder cooperation – particularly collaboration between the public and private sectors – has always been vital to achieving food security, just as it has always been vital to almost any major undertaking.

One reason why investors have a huge role to play in such a task is that public investment alone is unlikely to be sufficient to finance the largest and most complex projects. Another is that governments, because they tend to be relatively risk-averse, may be reluctant to back radical innovation before its potential has been proved.

Equally, it is wrong to assume the private sector holds all the aces. The investment community is sometimes portrayed as exceptional in its ability to address the world’s most pressing challenges, but this perception is unhelpful.³⁷ It is states and businesses’ combined efforts that can be uniquely powerful, as many of today’s most successful attempts to deliver food security show.

Take Singapore, which has a population of almost six million but a landmass of just 715km². Historically, the tiny republic has imported most of its fresh fruit and vegetables from Malaysia, Thailand, China and other neighboring countries.

In 2010 a public-private partnership between the Singaporean Agri-Food and Veterinary Authority³⁸ and a local start-up, Sky Greens, led to the introduction of vertical farming.³⁹ Sky Greens won a Singapore Sustainability Award in 2014⁴⁰ and featured in the Sustainia100 list of innovative companies the following year.⁴¹

Today, with urban agriculture boosted by further government grants, Singapore is recognized as a global leader in this field. Ranked 28th in the 2022 Global Food Security Index,⁴² it hopes to meet 30% of its population’s nutritional needs through local produce by 2030.⁴³



States and businesses’ combined efforts can be uniquely powerful, as many of today’s most successful attempts to deliver food security show.

Case study: Israel

At least at first glance, there are few grounds for believing Israel should excel at agriculture. Its original farmers were confronted by a barren landscape of desert and swamp, with poor-quality soil and a paucity of natural water resources.

Yet today Israel serves as a model for strengthening food security. Developing economies in particular are drawing lessons from the strategies it implemented more than half a century ago and, just as importantly, those it is implementing now.

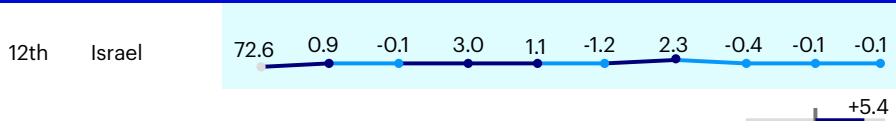
A study by the Tony Blair Institute for Global Change identified effective government and a market-oriented approach as key factors in Israel’s continued success.⁴⁴ In other words, Israel’s food security has been built on public-private collaboration.

The Israeli government devoted around 30% of its national budget to agriculture and water in the 1950s and 1960s.⁴⁵ More recently, reflecting the rise of agtech, it has established the National Center for the Application and Development of Genome Editing Technologies in Agriculture and set up a program to encourage interactions between public research and industry.⁴⁶

Meanwhile, innovative agtech businesses proliferate. They include GreenEye Technology, which makes AI-driven crop-spraying systems; Blue White Robotics, which produces kits that render farm vehicles autonomous; Tevel Aerobotics Technologies, which is working on fruit-picking drones; and SupPlant, a specialist in AI-based irrigation methods.⁴⁷

“If governments, researchers, development partners, farmer representations and the private sector could apply [the lessons of Israel’s] success to their work,” concluded the Institute for Global Change’s study, “Israel’s agriculture and water miracle can truly serve as an inspirational solution for developing countries still seeking such a transformation.”⁴⁸

Israel placed 12th in the 2021 edition of the Global Food Security Index. Its overall trajectory during the index’s first decade was positive, as shown below, culminating in a score of 78 out of 100. It placed 24th in 2022.



Source: Economist Impact: Global Food Security Index, 2021; figures show annual rises and declines in GFSI score between 2012 and 2021, plus overall rise

4.3. Understanding the bigger picture

The global population is expected to exceed nine billion by 2050.⁴⁹ Since food security cannot be achieved today, when the figure is eight billion, what might the cost of achieving it be – both literally and in much broader terms – in an even more challenging future?

Let us first deal with the purely financial element. As explained in another paper, we believe the necessary transformation of the food system will require investment of \$20 trillion to \$30 trillion between now and the middle of this century – making the transition one of the greatest growth opportunities ever.⁵⁰

The cost from a more general perspective is likely to depend on collective acknowledgement that the goal of feeding all of humanity cannot be pursued in isolation. As we have seen, the quest for food security has wide-ranging repercussions: history suggests it has too frequently come at the expense of the planet.

The lingering consequences of the Green Revolution underscore this point. The vast yields that once averted mass famine are now used to prop up industrialized farming, with most cultivatable land used for crops to feed livestock or for processed food.⁵¹

Ideally, the dream of global food security would be fulfilled to the benefit of the natural world rather than to its detriment. To put it another way: the objective should be to eliminate hunger while at the same time halting a grim trend toward environmental destruction, biodiversity loss and other unwanted aspects of the nexus of nature.⁵²

This cannot happen in the absence of continued innovation and close collaboration. As the European Commission advised in a 2022 report entitled *Everyone at the Table*, it is imperative to think for the long term and holistically.⁵³

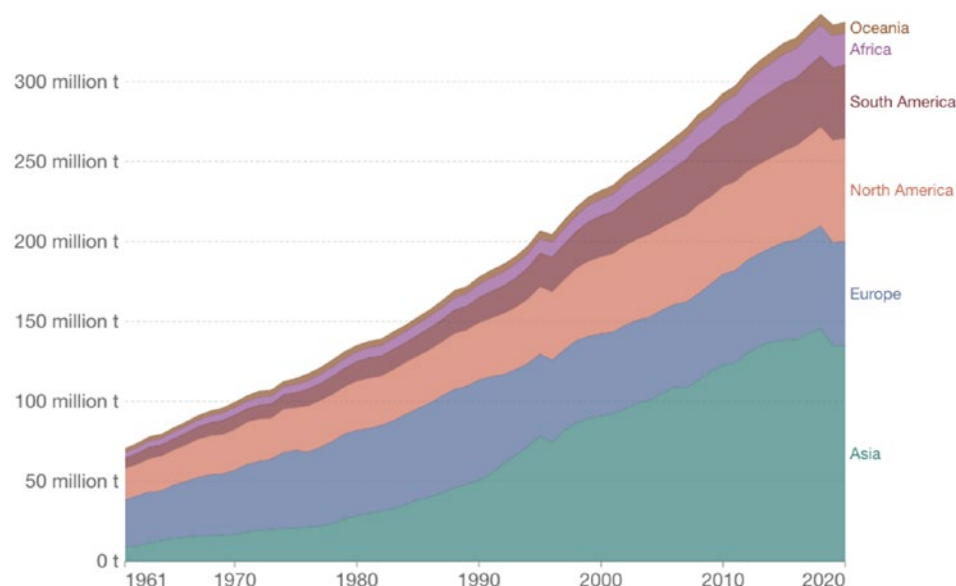
The message for investors is straightforward enough. We can invest in the status quo and thereby endorse the unsustainable; or we can invest in disruption and thereby support positive, lasting, far-reaching change.



The cost from a wider perspective is likely to depend on collective acknowledgement that the goal of feeding all of humanity cannot be pursued in isolation.

Twisted logic and warped priorities

The abundant crop yields made possible by the Green Revolution could have fed billions of people, but they were instead increasingly used to feed factory-farmed livestock. With meat production rising more than fivefold since the early 1960s, as shown in the diagram below, this damaging dynamic is central to the global food system's failings.



Source: Our World in Data: "Global meat production, 1961 to 2020", November 2019

5

Perspectives on the quest to feed humanity

5.1. Ingenuity, opportunity and optimism

Professor Jaideep Prabhu is Jawaharlal Nehru Professor of Indian Business and Enterprise at Cambridge Judge Business School. He is also a member of Cambridge Global Food Security, an interdisciplinary research center focused on the creation of an “ideal food system”. His work on food security includes Frugal Innovation, which was named the Chartered Management Institute’s Management Book of the Year in 2016.

In this Q&A Jaideep explains the different models of innovation that are increasingly reshaping food systems in developed and developing economies. He also highlights the importance of partnerships in driving positive change at scale and outlines why the power of ingenuity has never been so easy to harness.

Food security is obviously a global challenge. How will innovation tackle it?

I began my academic career by studying innovation in large Western companies – how an innovative culture is created, the role of senior management and so on. I found the dominant approach, broadly speaking, was to spend a lot of money and have big teams working on long-term projects.

Later, about 15 years ago, I became interested in how innovation works in emerging economies – including India, where I grew up. And I found the approach there to be very different to the Western model.

First, it was notably frugal. It was centered on the idea of doing more with less, often with a view to identifying highly affordable solutions for people outside the formal economic system. It was also flexible, agile and inclusive, with a lot of improvisation, lateral thinking and pivoting.

My colleagues and I wrote a book about this kind of innovation and the potential lessons for Western companies. And what we’re seeing now is that both types of economy are increasingly home to both types of innovation.

So innovation in the West is now much more driven by start-ups that are able to innovate faster, cheaper and better. Meanwhile, the more expensive, systematic type of innovation can sometimes be seen in developing economies as well.

This reflects the notion of innovation as a global force that responds to global challenges. From an investment perspective, it also underlines that there are opportunities to back potentially game-changing innovation right across the market-cap spectrum – including in the sphere of food security.

Could the same food innovations be applied everywhere at this stage?

Not necessarily, because much of the developing world still lacks basic infrastructure. Consider the issue of food waste, which shows how some of the fundamental problems in an emerging economy might differ from those in a developed economy.

Around a third of all food in the West goes to waste. This is often due to overproduction in the system. Retailers are terrified of having empty shelves, and overstocking and overbuying frequently result in waste at the point of consumption.

Equally, around a third of all food in the developing world goes to waste. But in this case the issues tend to be upstream. Food might go rotten in the field because there’s no means of preserving it. Crops might be damaged by drought or flooding. Too many farmers might take their produce to the same market, in which instance the price falls so low that they have no hope of making a profit.

So the idea of doing more with less is still especially relevant in emerging economies. At the same time, though, there inevitably comes a point when innovation needs to be scaled up to become truly impactful.



The upfront costs of innovating have fallen dramatically. We can now find out much more quickly which ideas actually work, and we can adopt them more rapidly as well.

Can you give us an example?

The dabbawallas of Mumbai are a great example. They deliver hot, home-cooked food to thousands of office workers every day. They go to a person's home in the morning, pick up a tiffin⁵⁴ box and then use trains, cycles and carts to deliver the meal to the customer's office in time for lunch.

Their delivery accuracy is almost 100%. On average, only one tiffin box in a hundred thousand goes astray. How they manage to be so successful with so little technology has been the subject of considerable study, including by business schools.

The idea was introduced some time ago. It predates Deliveroo, Uber Eats and other modern-day delivery services by decades. But now Flipkart, which is a major e-commerce company in India, has partnered with the dabbawallas to expand the concept.

So frugal innovation can provide some amazing solutions, but it's partnerships that ultimately enable them to be applied at scale. And these partnerships might be between start-ups and established businesses or between the private and public sectors.

It's really the same story in the West. I often give the example of the COVID-19 pandemic, where the initial vaccine came from a biotech start-up, a large pharmaceutical company got involved to facilitate testing and manufacturing, the government oversaw the rollout... Partnerships are vital when it comes to meeting major challenges and disrupting the status quo.

Can you give us an example of government playing a key role in positively disrupting the food system?

I recently learnt about the agricultural revolution that has taken place in Sikkim. This is the least populous of India's states, and it's relatively isolated and not particularly affluent.

The local government in Sikkim has moved the whole agricultural system from being dependent on fertilizers and pesticides to being organic. Such a transition is likely to reduce productivity at first, but in time the ability to certify produce as organic should translate into higher prices and increased revenues.

For this to happen, of course, farmers have to be educated on the need to absorb upfront costs. Policymakers have to convince them they will benefit over the longer term. So here, again, partnership is critical to positive change – and the hope in India now is that other states will follow Sikkim's successful lead.

Previous revolutions in food and agriculture have ultimately led to the unsustainable global system we have today. Why should we expect future revolutions to be more effective?

I think it really comes down to the fact that humanity's capacity to generate ideas – and, crucially, to share them – has never been so great. This isn't to suggest every idea is a good one, but the general proliferation of good ideas is clearly unprecedented.

There has always been human ingenuity, but today we have the tools to maximize it. Moreover, these tools are widely accessible. The upfront costs of innovating have fallen dramatically, especially during the past two decades. We can now find out much more quickly which ideas actually work, and we can adopt them more rapidly as well.

For example, look at what mobile technology is doing for farmers in India. It's helping them plan their planting and their harvesting. It's helping them boost their yields. It's helping them avoid the situation I mentioned earlier, where everyone conspires to drive prices down by turning up at the same market at the same time. It's a genuine game-changer.

I think that in the past there was much more focus on top-down solutions, whereas today we have a wealth of bottom-up solutions as well. Necessity is the mother of invention, and right now a lot of people are trying a lot of different and often pretty ingenious things. That makes me optimistic for the future.



The solution isn't to carry on trying to deal with crises as and when they occur – the solution is to take steps to prevent them in the first place by diversifying away from overreliance on intensive livestock farming.

5.2. Food security and factory farming

Dr Helena Wright is Policy Director of FAIRR, a global investor network that raises awareness of the environmental, social and governance risks associated with intensive food production. She was previously a Vice President at the World Wildlife Fund and also worked as a climate negotiator for the UK government.

In this Q&A Helena reflects on how global food security has eluded humanity to date, particularly in the wake of the Green Revolution that followed World War II. She also explains why the reform of a food system dominated by intensive livestock farming will be key to at last realizing this long-held goal.

[Do you think there has ever been a point in history when global food security has seemed a genuine prospect?](#)

During the early years of the Green Revolution, when what was happening in agriculture was rightly seen as transformative, there must have been a real sense that it could happen – almost a sense that pretty much anything was possible. Doubling yields, tripling yields, preventing disaster in countries facing mass famine – this was in some ways a truly amazing period of innovation.

The problem, of course, was that it was a revolution that didn't last. It achieved a lot of fantastic things, but it lost its way over time – so much so that now we don't even want it to serve as the basis of the next revolution. All it can really tell us today is what not to do in the future.

[Why do you think it lost its way?](#)

FAIRR's founder, Jeremy Coller, recently wrote a paper on this issue, examining why the Green Revolution fell apart and the lessons we need to learn.⁵⁵ One of the main conclusions is that the revolution failed because there came a point when the massive crop yields it generated were used to feed intensively farmed livestock instead of the human race.

Think about that. We produced a huge surplus of cereals that might have been used to feed billions of people, but instead that abundance was used to feed the billions of animals – around 80 billion now⁵⁶ – that underpin a worldwide system of industrialized, intensive farming.

That's why the Green Revolution arguably fueled a food system that works against us, not for us. The tragedy is that an idea that began with the best intentions somehow led to a status quo that's now heavily implicated in climate change, deforestation, the depletion of water supplies, disease and other global challenges.

[Do you think that shift – from using a surplus to feed humanity to using it to feed factory-farmed animals – was deliberate?](#)

I certainly don't think it was envisaged from the outset. I don't believe the architects of the Green Revolution wanted to develop the sort of system that emerged over time.

In fact, if you read about Norman Borlaug and the other scientists behind the revolution – not to mention the Rockefeller Foundation, which financed so much of their work – you'll find their motivations were entirely noble. One even said it would have been “almost wicked not to have done what a person could do to help out”.⁵⁷

But we have to place the overall chain of events in context, especially from the perspective of the farming community. Remember that farmers eventually saw their profits collapse because of an overabundance of supply, so it would have been only natural for them to seize the chance to profit from a new opportunity – which is exactly what the advent of intensive livestock farming offered.

The reality is that human nature usually compels us to seek growth and a better standard of living. Very few farmers were going to stand back and wonder whether this path might one day have a negative impact on the greater good. Let's be honest: they could scarcely have imagined where it might lead. So they took the money – and that's understandable.

This is actually now a key challenge for the Ever-Green Revolution. We need to ensure a just transition for farmers everywhere. The new food system has to provide them with a sustainable future, not cast them aside.

So what needs to happen now in order for an Ever-Green Revolution to succeed?

First and foremost, we need to acknowledge intensive livestock farming represents a serious problem – often a deadly serious problem. There’s always a lot of attention focused on the symptoms of the crises confronting this planet and its inhabitants, but we need to be brutally frank about the causes.

There’s no disputing that intensive livestock farming contributes to these crises. The evidence is overwhelming. So the solution here isn’t to carry on trying to deal with crises as and when they occur – the solution is to take steps to prevent them in the first place by diversifying away from overreliance on intensive livestock farming.

And the key point is that we can now do that. As Jeremy says in his paper, we have “the tools for utopia”. With the help of the investment community, agtech and foodtech can sweep away the old system, build something truly sustainable in its place and finally make global food security a reality.

5.3. Investing in a food-secure future

Glen Yelton is Invesco’s Interim Global Head of ESG. He was previously Head of ESG Client Strategies in North America and EMEA. Before joining Invesco he was Director of ESG and Impact Investing at OppenheimerFunds and also held ESG-related and research-related roles at a number of investment, data and ratings businesses.

Conor Hartnett is Invesco’s ESG Client Strategies Manager in EMEA. He previously worked for CDP (formerly the Carbon Disclosure Project), including serving as its Senior Project Officer for Capital Markets.

In this Q&A Glen and Conor discuss how a culture of overreliance has pushed the food system to the brink of collapse. Warning against a “business as usual” mindset, they make the case for sweeping transformation, accelerated progress and long-term benefits for all stakeholders.

What can recent events tell us about the quest for food security?

GY: Maybe the most important lesson – one that has become absolutely impossible to ignore – is that we have a global food system that’s tremendously vulnerable. It’s a system that has been built on overreliance and which is dangerously susceptible to shocks.

We all know the war in Ukraine made things considerably worse, but we shouldn’t ignore the fact that the situation was already extremely serious. The system had been under severe strain for many years, thanks to issues such as population growth and climate change, and it was then further weakened by the COVID-19 pandemic.

The World Food Programme warned back in 2021 that 2022 would be “a bad year for world hunger”. It blamed “a toxic intersection of several crises”.⁵⁸ And then another massive crisis came along.

So it was virtually inevitable that the system’s failings would be laid bare at some point – and that’s the stage we’ve now reached. When the UN Secretary-General talks about an “unprecedented hunger crisis”, with nearly 300 million people facing food insecurity,⁵⁹ there’s no denying that the status quo is wholly unsustainable.

In what ways has this unsustainable status quo been “built on overreliance”?

GY: There are many ways. There’s an overreliance on fertilizers. There’s an overreliance on irrigation. There’s an overreliance on industrialized methods and the factory farming of livestock.

But perhaps the overreliance that has become most obvious in light of recent events is an overreliance on traditional crops. Global wheat production in particular has been caught up in something of a perfect storm.

The world’s biggest producer, China, claimed in early 2022 that it was on course for the worst harvest ever.⁶⁰ This prediction followed unusually heavy rainfall during planting, which cut available acreage by a third. The harvest later turned out to be good – at least reportedly⁶¹ – but the mere threat of a poor crop was another sign of the pressures under which the global food system now operates.

Meanwhile, the second-biggest producer, India, saw production affected by extreme heat.⁶² Forecasts in the US were down as well.⁶³ And Ukraine and Russia supplied almost 30% of globally traded wheat prior to the war.⁶⁴

This underlines the extent to which a huge reliance on traditional produce and methods is increasingly at the mercy of factors such as the weather and conflict. It also underlines how these factors are capable of almost crippling the system in a short space of time – with potentially disastrous consequences across local, regional and global supply chains.

This means a fundamental challenge in achieving food security is to not only modernize but diversify the food and agriculture sector and its outputs. “Business as usual” simply isn’t an option.

As investors, what can we learn from success stories such as the UAE, Israel and Singapore?

CH: They’re countries that prove the solution lies in transformation. In turn, they prove transformation is possible only with substantial investment.

They’ve all made very significant investments in disrupting their food systems with a view to achieving food security. They’ve shown innovation is essential, and they’ve shown cooperation between the public and private sectors can provide a great platform for large-scale transition.

We might also say they’ve shown what’s possible. None of these countries could be said to have the ideal conditions for traditional food production, so they’ve instead set about developing the ideal conditions for novel forms of food production.

They’re now able to focus on what they really need – for example, fresh fruit and vegetables. They’re embracing tech – not just out of necessity but in the knowledge that it marks the way forward in every respect. They’re exploring alternative sources of protein, such as plant-based and lab-grown products.

They’re also creating much more promising jobs for people whose employment prospects were previously linked to the unsustainability of conventional policies and practices. This is a lesson that’s likely to be especially useful for African countries and other developing nations where agriculture is among the largest employers.

These are stories that highlight the far-reaching, profoundly positive impacts of disrupting the food system. And for investors, of course, they also highlight the scope of the investment opportunities this theme presents.



Look at any country that has invested in its food system and you'll see the biggest strides have been made in recent years.

Israel's journey toward food security arguably began around 70 years ago. The UAE's might be said to have started more than 20 years ago. Realistically, how long might we have to wait before we attain food security worldwide?

CH: The key point here, particularly given those examples, is the immense acceleration of progress. Look at any country that has invested in its food system and you'll see the biggest strides have been made in recent years – allowing, of course, for temporary setbacks caused by extraordinary events such as the pandemic.

Israel may have laid the groundwork many years ago, but it's tech that has ultimately propelled it to the forefront. Similarly, the likes of the UAE and Singapore have come a long way in a relatively short space of time because of their determined focus on cutting-edge innovation.

This shows the potential for effective, lasting disruption has never been greater. With the right investment, what has happened in those countries could happen anywhere – and in many cases, even in developing economies, the seeds of change are already sprouting.

This doesn't necessarily mean we'll suddenly be back on course to achieve zero hunger by 2030 or even 2050. But the possibilities are certainly growing – and let's not forget, too, that this is a long-term investment theme that will continue to deliver wide-ranging benefits even after hunger finally becomes a thing of the past.

6

Conclusion



The dream of food security has often turned out to be the stuff of rhetoric. We believe it could yet turn out to be the stuff of reality.

Global food security is still far from imminent. The goal of the Rome Declaration – the lofty ideal of a world in which “all people, at all times, have physical and economic access to sufficient, safe and nutritious food” – remains distant.

Yet there is an important difference between how the issue of food security can be seen today and how it might have been seen in the past. Today, rather than viewing it as an enormous but self-contained problem, we recognize the enduring quest to feed all of humanity as one of many interconnected crises linked to a food system in desperate need of disruption.

As has already been shown, this accumulation of crises can prove damaging – and even devastating – over the short term. With the longer-term implications even more disturbing, there is little doubt that positive and lasting change marks the only viable way forward.

In the past, whether expectedly or not, the dream of food security has often turned out to be the stuff of rhetoric. Sometimes, as in the aftermath of World War II, it has turned out to be the stuff of revolution – albeit fleetingly. In spite of the scale of the challenge and the specter of a “perfect storm”, we believe it could yet turn out to be the stuff of reality.

As we have explained, the near-relentless pace of technological progress – as most obviously evidenced by the emergence and rapid adoption of agtech – offers the promise of continued radical innovation in this sphere. This was a luxury unavailable to previous generations.

In concert, the power of public-private partnerships – as demonstrated by the success stories attached to many of the leading countries in the Global Food Security Index – is also likely to further this journey. The synergies of such collaborations have perhaps never been more manifest.

The FAO has expressed grave doubts over whether global food security can be realized by 2030 or even 2050, as observed earlier. Ultimately, nobody can say for sure how long the world will have to wait. But this much is certain: whatever the timeframe, investors will have a major role to play – not just in financing the necessary transition but in ensuring it is achieved without compromising other aspects of the broader bid to build a truly sustainable future.

7

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