

An unfolding global hunger crisis?

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July 2022

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Correct citation

Müller, A., Prakash, A., and Lazutkaite, E. 2022. An unfolding global hunger crisis? The developed world must share their grain reserves with countries in need instead of producing biofuels and meat! TMG Working Paper. <https://doi.org/10.35435/2.2022.4>

Acknowledgements

This publication was made possible with the financial support by the German Federal Ministry for Economic Cooperation and Development (BMZ).

1 Introduction

The world in 2022 faces the intertwined challenges of climate change, Covid-19, conflict and rising living costs that are having huge disruptive impacts on the global economy. The economic paradigm, which we all have been accustomed to for more than 30 years – that of “globalization” – puts the “comparative advantage” of nations to the fore in driving international trade and prosperity to new heights. The different regions of the world are being knit together under high specialization and frictionless markets, but this paradigm has begun to unravel. Covid-19 has demonstrated the fragility of global supply chains, while Russia’s war in Ukraine has unveiled the dependency of world food security on the uninterrupted international trade of “cheap” agricultural commodities as well as on the pervasive use of fossil fuel-based inputs such as nitrogen-based fertilizers; the global production shares of which are highly concentrated in these two countries alone.

Despite a record harvest of grains in 2021 and ample stocks, resulting in enough food being able to feed everybody, the number of hungry people in the world has started to rise again. The reason is not for a lack of food (yet) but a rapid increase in the price of food. The interruption of exports of wheat, other grains and sunflower oil from Russia and Ukraine coupled with the very high prices of fossil fuels has led to skyrocketing costs for food and for fossil fuel-based fertilizers. These shocks have contributed to an upwardly spiralling dynamic of increasing food prices that is hitting the poorest people, especially in developing countries where food expenditures account for a very large share of household income.

In this paper, we discuss the possibility that today’s food price crisis, in the absence of urgent action, might turn into a fully-blown hunger crisis in many parts of the world, creating a situation only comparable with the 1970s during which millions of people starved. We are purposefully examining a highly plausible scenario that is based on a specific assumption: high prices for fertilizers and a possible scarcity of inputs, which might lead to a situation where the current food price crisis will turn into a crisis of availability of food. Why are we looking into such a scenario? The ongoing crisis confers with what scientific research uncovered previously: global trade in agricultural commodities is based on the increased use of “cheap” fossil fuels, with drastic increase of prices reflecting scarcities of such fuels – either managed limits on supply or when supply cannot match demand, leading to transportation difficulties that disrupt logistical systems, where such systems have become more and more indispensable for food security in vulnerable countries, especially food importers. Worrying evidence is already emerging that the existing crisis of high prices for food might turn into an even more deepening crisis, with potential food shortages having both far reaching and devastating consequences for those most exposed to food insecurity, which threatens to undermine peace and stability in many regions of the world.

We also want to avoid a possible misunderstanding: we are by no means promoting action that will give the (wrong) impression that more fossil fuel fertilizers will solve the problem of making more food available in the long-term. This is a clear fallacy. We need a fundamental transformation of the system as a whole in order to provide healthy food for a growing population (now at 8 billion persons) without destroying the natural resource base and rendering more climate variability

on which food production relies. We want to use this scenario to also make a resounding call for short-term action to avoid a catastrophic outcome in which tens of millions of people are exposed to chronic hunger or in which they endure famine, while at the same time, transforming food systems towards sustainability and resilience. And, we are aware that our scenario might be used by proponents of the status quo (that continue to bring us to this predicament). Therefore we are offering a solution beyond the “business as usual” approach; developed countries that are using huge amounts of grain not for direct human consumption but for use as biofuels and animal feed, should make a reliable commitment to release stocks to countries in need, and at the same time work on the necessary implementation of the transformation of the food system to overcome the intertwined threats of the 4 Cs, namely climate, Covid19, conflicts and (high) costs.

The prospect of the impacts of the climate crisis combined with the current scarcity or the high prices of fertilizers is threatening global food security and cannot also be solved by way of “business as usual”. We have to overcome a situation, in which subsidies for unsustainable agriculture and short-term measures to ensure the supply of agricultural commodities to the heavily dependent regions of the global south, are no longer tenable in guaranteeing long-lasting food security. For the current global system of trade in agricultural commodities is heavily contingent on the excessive use of fossil fuel-based fertilizers with its negative impacts on the climate, on soil fertility and biodiversity. The key challenge to be addressed is to avoid a shortfall of food in the years to come, necessitating concerted efforts to transform the current unsustainable and shock-prone food system. While it is necessary to keep markets open and

to support food inflows in the affected countries, limiting solutions to these conventional steps will not be sufficient to achieve a food-secure world. They only serve to defer the necessary transformation of food systems, perpetuating episodes of food crisis and perplexing solutions to dissipate such episodes. The poor always pay a very high price for convention, which invariably puts peace and stability at risk and with global implications.

As a bridge to this much needed transformation and to avoid the near-term prospect of famine-related mortality, lessons can be learnt from the recent (and ongoing) global health crisis – Covid-19 – in which the world rapidly developed effective vaccines but in the beginning failed to share vaccines with developing countries or to allow the use of patents for far too long. Thus, in the context of the global food crisis, interventions of a similar scale are needed such as the release of food and fertilizer stocks for global distribution to avoid starvation. The developed world needs to make the firm and reliable commitment that in case of possible shortages of food our stocks will be shared, and we would reduce production of biofuels and meat. Food for everybody must come first. This can be regarded as a practical example of “Leaving no one behind”.

The call for transforming food systems to render them more resilient to crisis is a central tenet of this paper. But an important objective is also to understand current developments in global food markets, especially the outlook for the 2022/23 season, and how might a severe hunger crisis unfold, given the prospect of fertilizer application shortfalls that could instigate food shortages. Our analysis suggests that the fertilizer issue will have profound impacts on global hunger, notwithstanding TMG’s analysis on nearer term climate change impacts

on staple foodstuffs among vulnerable regions in the tropical belt – where climate extrema are set to be felt the most. Simply put, climate change is likely to compound the effects of conflict (which is driving high energy costs and fertilizer scarcity) as well as ill-functioning supply chains, all of which makes a recipe for a hunger crisis. The paper concludes with an assessment of initiatives being considered by the multilateral system to dispel the current crisis including their relative merits, and provides details of how food systems need to be transformed for increased resilience against price and supply shocks.

2 Background

Not since the great food crisis of the 1970s, in which millions of people died as a result of hunger and malnutrition, has the world faced a similar threat. Today, we cannot exclude the possibility that food shortages in the coming years will dwarf the crisis of 2006-2009 – the “perfect storm” – as well as the auxiliary shocks between 2010-2014. These more recent episodes were mostly confined to soaring food prices, but with no apparent global food shortages. Today, however, the four “Cs” (Climate, Conflict, Covid and high Costs) are conspiring to instigate the prospect of a severe hunger crisis around the world, rendering production deficits in major exporting countries to feed populations in import-dependent countries. Many food importing countries in developing regions lack the necessary foreign exchange to procure food from international markets. With the world highly dependent on well-supplied global markets, the situation is being exacerbated by the rising prolificacy of export bans on foodstuffs to shield major suppliers from domestic inflationary pressures and scarcity. Such knee-jerk reactions are contrary to the strongest of all

recommendations by the Agricultural Market Information System (AMIS) of the G20 – instituted as the governance body for global food trade – to keep the sanctity of the function of trade. Incidentally, however, AMIS has fallen largely silent in recent months, at a time when global leadership is paramount.

The Four Cs

As we begin the 2022/23 crop season, planting in the major breadbaskets of the northern hemisphere has begun and prospects of sufficient international and domestic availabilities of the most basic staples: wheat, rice and maize, to feed the world are far from reassuring. Climatic events, such as unseasonal drought and heat stress are already taking their toll on plantings. Prolonged conflict, especially the Russian war in Ukraine will curtail severely its significant food supplies from reaching international markets since Black Sea ports are blocked (while, despite efforts, surface transportation has its limitations), notwithstanding reports of Russia seizing or destroying Ukraine's grain silos, harvesting machinery and crops on the ground. The Russian Federation (the world's leading fertilizer and wheat exporter) has also announced restrictions on fertilizer shipments until 2023/24, and a ban on wheat exports until June 2022. Covid-19 still casts a long shadow on the efficacy and efficiency of global supply chains to meet the world's food and other essential needs. These developments are all combining to heighten the cost of food production that invariably transmits to consumer prices at the retail level, making hunger a real prospect.

Transforming our energy-hungry food systems

What binds the interconnectedness of the four Cs, or simply their common denominator, is the price of fossil fuels. The price of crude oil (arguably, the fifth “C”), has been pivotal in history (notably in the oil price shocks of the 1970s as well as today) in instigating booms and busts in commodity markets, including food. This is because fossil fuels are the primary energy source to power mechanized agriculture, as well as the main ingredient for fertilizer production, which is critical for industrial crop productivity. Moreover, the non-renewable energy sector is perversely subsidized to the tune of USD 5.9 trillion per year (8 percent in direct subsidies, and the remainder in the form of environmental harm, unpriced pollution and CO2 emissions). Such is the grip of the fossil fuel industry in the world's leading emitter of CO2 – the United States – that the country's highest legislature has eased regulation of emissions. This is important, since it is commonly understood that over seven units of fossil fuels are typically needed to produce one unit of food energy (calories) in developed countries. In doing so, fossil fuels continue to hold the global economy, our food security (in the form of fertilizers and energy needs) as well as our climate to “ransom”. A complete rethink and re-orientation of policies away from the support of destructive fossil fuels is now more than ever a global imperative. Repurposing such subsidies towards transforming food systems on a pathway to sustainability would be a major step forward in solving long-term global hunger.

This update to a prior TMG paper on the unfolding food crisis, casts increasing doubt on the world's capacity to feed itself in 2022/23 and

beyond. Such is the gravity of prospective crises that comparisons should now be drawn with the extreme hunger episode of the 1970s. Then, a crude oil embargo that raised the cost of energy and fertilizers in tandem with poor harvests owing to drought led to food shortages on a global scale. History repeats itself. The chief protagonist for the making of the looming hunger crisis today is high energy prices that are hampering farmers' affordability of fertilisers, which beyond all has been the major historical driver for the world's ability to provide food, notwithstanding a stable climate. As we enter the 2022/23 crop calendar, climatic events already do not bode well for a bountiful season.

3 Developments in food markets

After witnessing periodic shocks, the initial idealism that accompanied the globalization paradigm (dependability, reliability of international markets to satisfy ever-expanding global demand) has mostly waned. Macroeconomic policies that drive global excess liquidity (low interest rates, quantitative easing) and US dollar depreciation bring forthwith greater affordability that lead to a rapid rise in world-wide demand, especially for fossil fuels to “power” industrial expansion in emerging economies. This situation is invariably a pretext for price booms in commodity markets. What is more, subsidized food production chains that ignore “true environmental and human health costs” are hiding the true cost of food and are drivers of unhealthy consumption patterns. This trend is becoming so rife, it is leading to a rise in global obesity and malnutrition, in all regions of the world – at different speeds. Now, supply disruptions play a pivotal role in placing food prices on an upward trajectory, in which production

shocks – as a result of geo-political tensions and conflict (e.g., Russia’s war in Ukraine), the Organization of Petroleum Exporting Countries cutbacks (e.g., in mid-2021), adverse weather events and logistical disruptions (e.g., Covid-19) that impede market functioning.

The benchmark indicator of global food prices – the FAO Food Price Index (FFPI) – surged 19 points in March 2022 from the prior month, the largest jump on record, to an all-time (nominal) high of 160 points, before falling to 157 points in May 2022 (figure 1, panel A). The index, however, does not portray the incessant rise in cereal prices – the commodity group that has the largest bearing on global food security. Panel B shows how the influence of crude oil price booms transmit (dashed lines) to food markets, leading to similar booms, which have become more pronounced in recent decades owing to rising economic integration. Energy prices

too, which influence the cost of food production, especially through mechanized agriculture in major exporting countries and the price of fertilizers, particularly nitrogen from which the essential nutrient is derived from natural gas, are arguably the reasons for surging crop prices. Panel C of figure 1 shows this passthrough.

While farmers including major exporters tend to prosper in price booms, such periods are often short-lived when price incentives instigate a supply response, facilitated by continuous cropping seasons in the northern and southern hemispheres that bring global food markets swiftly back into equilibrium. This has often been the case in the last two decades that dissipated crises, but this is clearly not the case today, with different forces (the rising cost of energy and fertilizers, as well as irregular climate patterns) seemingly conspiring to protract the current crisis, casting

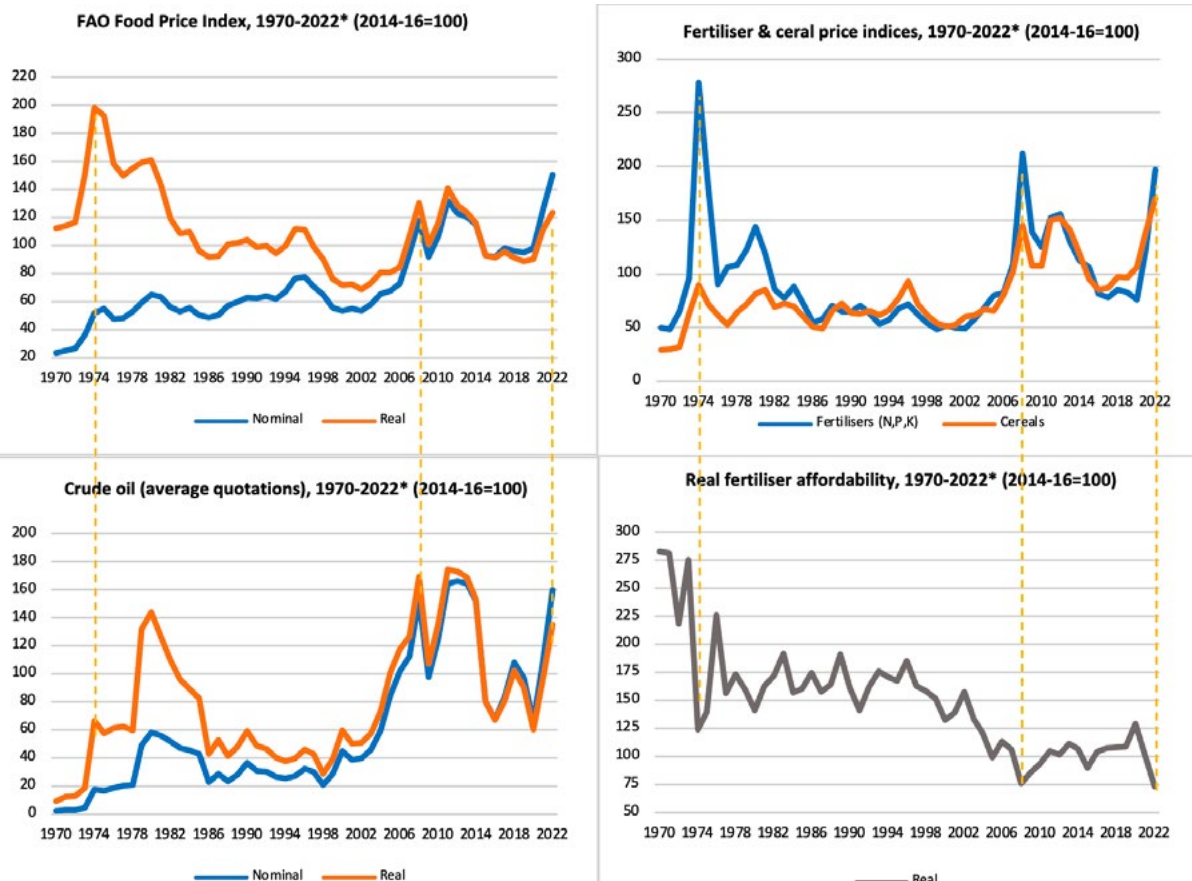


Figure 1: Price indicators of food crises (Source: FAO, WB and authors’ calculations) * average Jan-May 2022.

doubt on whether supply responses can be both quick and sufficient.

An index of international fertilizer prices (Nitrogen, N; Phosphate, P; and Potassium, K) reached a record high in the months beginning 2022. In Panel D, the ratio between fertilizer (input) prices and crop (output) prices has an important bearing on “affordability” or “real crop prices at the farmgate” – which, reached a record low in the months of 2022. Of concern is the current growth in fertilizer prices that is clearly outpacing that in food prices, disincentivising farmers from ramping-up food production. As discussed in the next section, the issue of unaffordable agricultural inputs beyond the short-term has arguably the largest bearing on the prospect of global hunger. prospect of global hunger.

for maize, in which yields are estimated to decline by 41 percent without N fertilizer, or in other words, nitrogen is responsible for 41 percent of maize yield. At the other end of the spectrum lies Soybeans, in which N plays no part in yield reduction, which is primarily due to the inherent nitrogen-fixing properties of the crop. Of course, had the effects of other nutrient inputs such as P and K been accounted for, estimated yield reductions in all crops would have been much greater.

Against the backdrop of rising fertilizer prices, Table 1 is also indicative in understanding how farmers' decision-making is influenced, i.e., what crops to grow, how much to grow and the extent of fertilizer application. Driven by expected profit maximization, planting decisions have huge potential implications for current and future global food security.

Crop	Baseline*	Without N fertilizer	Reduction (%)
Maize	7.65	4.52	41
Rice	6.16	4.48	27
Sorghum	4.64	3.76	19
Wheat	2.15	1.81	16
Soybeans	2.28	2.28	0

Table 1: Estimated effect of N fertilizer on selected crop yields. *Baseline is from USDA (1987)

4 Why high fertiliser prices matter

Fertilizers are instrumental in the current system of global food security in raising crop productivity and hence profitability in the farming sector in normal times. To illustrate their importance, Table 1 provides an example of how the absence of applying solely nitrogen (N) can contribute to yield declines for key staple crops. The highest impacts are

5 Global production prospects in 2022/23

The war in Ukraine shows no sign of let-up. Russia and Ukraine constitute the world's major exporters of wheat, with Ukraine also being the leading exporter of sunflower oil. Ukrainian ports in the Black Sea are closed owing to a blockade by Russia and also have been mined to thwart attempts of a

land invasion, negating the prospect of any substantive international food exports other than small railway shipments along its borders, while ports in Russia are deemed unsafe for freight vessels. With Russia ranked as the world's foremost supplier of fertilizers, it has restricted exports of the commodity, as well as grains (even though Russian food and fertilizer sources are exempt from sanctions) under the pretext to safeguard their food security and to check inflation. In a similar vein, China has also banned fertilizer exports (with a 10 percent share in global urea supply). On the balance of probability, Russia's restrictive trade policies and those it has inflicted on Ukraine, can be construed as a pretence for retaliation against sanctions. At a recent UN Security Council meeting, Russia was accused of using food supplies as a "stealth missile" against the developing world, raising food prices and forcing people into hunger and poverty, while the European Union's foreign-policy chief has charged Russia with "weaponizing grain".

Fertiliser affordability is going to be key in 2022/23 and beyond

These developments are set to perpetuate high food prices through rising scarcity instigated by high costs of production into 2022/23 and beyond. Already, the impacts of higher fertilizer prices for the new season are being felt. The International Rice Research

Institution reports that fertilizer prices are beyond the reach of many farmers, to the extent that the world's second most important staple could witness a conservative 10 percent decline in yields – enough to feed 500 million people. From sub-Saharan Africa to South East Asia to Latin America, expected declines in food production are at an unprecedented scale and are endangering lives. In the United States, many farmers in 2022/23 are switching from maize to soybeans, since soy is far less N-intensive than maize, but does require P and K. This also comes at a time in which the US Administration has wavered a ban on the 15 percent blending mandate (maize-based ethanol) with gasoline (E15), in order to dampen price pressure at the pump. It also comes at a time when the world's insatiable appetite for livestock products requiring huge amounts of grains to rear animals, continues unabated. It is thus likely that maize and other feed prices, which could be made available for human consumption, will continue rising into the new season.

To gauge the impact of lower N use (an example 50 percent) on hunger for the most food-insecure regions in the world – sub-Saharan Africa, South Asia and South Eastern Asia – we have derived some highly preliminary estimates in Table 2, using FAO's latest (2020) hunger metrics as a baseline and N metrics in Table 1.

The estimates are telling. In sub-Saharan Africa, while fertilizer application rates are among the lowest

	Population (mn)	Cereal	With N		Without N	
			number undernourished (mn)	%	number undernourished (mn)	%
South Asia	1963	Wheat, Rice	306	16	356	18
South Eastern Asia	675	Rice	49	7	60	9
Sub-Saharan Africa	1122	Maize, Rice	264	24	318	28

Table 2: How lower N-fertiliser application could increase hunger

in the world (17kg of nutrients per ha compared to a global average of 135kg), which is reflected in their yields, an additional 52 million people or 4 percent could be pushed in chronic hunger, through maize shortfalls, while in South Asia (wheat and rice) an extra 50 million would face food deficits and in South Eastern Asia (rice) the estimate is around 11 million, or 9 percent of the region's population. The production shortfalls could be accommodated by imports, but those afflicted by hunger do not have the financial means (i.e., necessary foreign exchange reserves) to cover their food deficits from the global marketplace. Furthermore, Table 2 does not take into account lower P and K applications to cereals, nor N, P and K on other crops (e.g., sugar, fruits and vegetables, and oilseeds), nor does the table incorporate rapid rises in the cost of living, in which household budgets are already being stretched to the limit on food and energy expenditures. According to the International Labour Organization in 2021, around 50 countries situated in the three regions were spending between 60-90 percent of their incomes on the basic necessities of food and energy. With the prospect of limited international fertilizer availability for the foreseeable future, a deeper analysis on the impact of declining use in N, P and K on food security and hunger is clearly warranted.

Looking at the bigger picture, economies are beginning to shrink while inflation soars. "Stagflation" is a rare phenomenon that is thought to be caused by crude oil price shocks and is widely feared by economists since policy options to bring the economy back to equilibrium are limited.

How are weather conditions expected to play-out in 2022/23 and beyond?

At this stage, it is difficult to assess the extent to which the global harvest will be impacted by climatic extremes. However, a record-breaking drought reordered plantings in the United States, heat stress in India has led to a reported 10-35 percent decline in crop yields with more heatwaves predicted prompting a ban on the country's wheat exports. Devastating heatwaves are also being felt in Italy and as far as field as Japan, while the Horn of Africa is being ravaged by the worst drought in four decades and has one of the lowest rates of irrigation, where only around 1 percent of arable land is equipped for irrigation.

The longer-term prognosis for a changing climate on crop production is disturbing, especially where its effects are expected to be felt the most – the earth's tropical belt. Using analytical datasets integrated with the Intergovernmental Panel on Climate Change scenarios, TMG has established forecasts for worldwide food production and yields for the decades to come. Maize and rice productivity in Western Africa (the two prominent staples) could, on average, fall by as much 15 and 10 percent, respectively, in the next decades, while in Northern Africa, crop production will likely collapse. In South-eastern Asia, rice productivity in the world's largest rice exporting country, Thailand, could decrease by 5 percent, and in Southern Asia, yield declines in rice could be in the order of 4 percent. Additionally, these projections assume affordable fertilizer availabilities. Consequently, the combination of climate change and our heavy reliance on fossil-fuel based inputs in global food systems could spell catastrophic effects on global food

security, raising the prospect of widespread famine, further conflict and climate migration.

6 What is the multilateral system doing now to avert impending hunger?

There is a sense that concerted action is seemingly too little, too late or in vain to avert the prospect of a hunger crisis:

- FAO has proposed a “food import financing facility” (FIFF), with a foreseen budget envelope of a maximum USD 25 billion, based on current eligibility criteria for selected countries to enrol. However, given that the global food import bill is likely to hit a record USD 1.8 trillion in 2022, with many countries paying more for less imports, which increases the prospect of many more countries being pushed into the economically-vulnerable territory, the FIFF would thus surely need to be expanded. Questions arise as to how far richer countries, or the IMF, would be willing to increase the funding envelope that could conceivably increase in order of magnitude.
- In parallel with the FIFF, another initiative to mitigate crisis could be a scheme for the financing of mineral fertiliser imports for an interim period of time, especially nitrogen. Countries of agricultural importance that historically have been highly dependent on such imports, would be eligible to participate. Parallel to this interim solution, a firm pathway needs to be set-up to drastically reduce the dependency on fossil fuel-based fertilisers. Decoupling agriculture from fossil fuel-based inputs towards renewable alternatives would be a major step towards the much-needed transformation of the sector. Agriculture must aim at using the ability of plants combined with modern technologies to become net energy positive. Currently, over seven units of fossil fuel energy are required to produce one unit of food.
- The main issue today, however, is that Russia dominates this market by way of its massive exportation of fossil fuel-based fertilisers, and while the country is free of sanctions to ship nitrogen, Russia's reliability to supply the scheme can be called into question. The risk is high that Russia will continue to use fertilisers as a means for geopolitical gain. The stakes are very high given the importance of nitrogen for raising crop yields in today's system. Consequently, other countries with nitrogen stockpiles and who are currently food-secure could be a surrogate. This all being said, established methods to fix nitrogen into soils should be explored and massive investments are needed for identifying how soils can be kept fertile or how they can be naturally restored. It is unfortunate that both a source of the crisis and an immediate solution rests on fossil fuels. We must avoid any scenario in which world food security becomes more “addicted” to fossil fuels. Agriculture should and can become part of the solution if vested interests can be overcome.
- Furthermore, the mantra of AMIS of the G20 – established as the primary governance mechanism for global food security – is the avoidance of export restrictions, but as in the past, these calls go unheeded, with many major producing countries banning exports to contain domestic inflation. Moreover,

Box 1. G7 Summit 2022

The extracts are taken from the [G7 Leaders' Communiqué](#) and the [statement on global food security](#) published on 28 June, 2022.

- We commit to an additional USD 4.5 billion to protect the most vulnerable from hunger and malnutrition, amounting to a total of over USD 14 billion as our joint commitment to global food security this year.
- We will strive to address fertiliser shortages by supporting more efficient and targeted usage, temporarily increasing local and global production as appropriate, and promoting alternatives to inorganic fertiliser.
- As a short-term relief, we call on those partners with large food stockpiles as well as on the private sector to make food available without distorting the markets, including by supporting the World Food Programme's purchase strategy. We call on all countries to avoid excessive stockpiling of food which can lead to further price increases.
- We support the initiative carried out by the International Fund for Agricultural Development (IFAD), in coordination with the African Union (AU), to design a strategic investment plan to accelerate development of value chains essential for Africa's food resilience.

ENERGY

- We commit to end new direct public support for the international unabated fossil fuel energy sector by the end of 2022, except in limited circumstances clearly defined by each country consistent with a 1.5 degree Celsius warming limit and the goals of the Paris Agreement.

Nevertheless, G7 expressed temporarily support for the investments in fossil fuels in the face of the current crisis:

- In these exceptional circumstances, publicly supported investments in the gas sector may be appropriate as temporary measures.

Russia's membership threatens to undermine any effort to effect governance.

- In June 2022, the G7 seemingly subsumed the role of G20-AMIS by announcing a series of measures, both short- and longer-term, to tackle the crisis head on (see Box 1. G7 Summit 2022). G7 leaders agreed to keep food and agricultural markets open and encouraged Russia to end any activities that impede Ukrainian food production and exports. In addition to direct financial support, the G7 announced plans to boost fertilizer production and to promote the supply of organic fertilizers. Leaders also encouraged the release of food from stockpiles, and for the longer-term, they recognized the strategic importance of investing in value chains in Africa for enhancing

resilience. Finally, the G7 agreed not to introduce any new public subsidies for fossil fuel sectors, however, leaders recognized the need for additional but temporary investment in the natural gas industry to mitigate current supply shortages.

Extraordinary times call for extraordinary measures

While the G7 Leaders' Communiqué is a refreshing breakaway from tradition, the world still has much to learn from history. The world was ill-prepared in the 1970s, the 2000s as well as today. Arguably, solutions to fix increasingly complex and intertwined food systems are difficult. Vested interests, a lack of governance and a system of economic accounting that undervalues our

natural and societal capital are challenges under which transformation of our food systems needs to happen. This task is by no means underestimated, but bold action is needed to ensure food systems become more crisis-proof.

To begin, a forceful take-home message is that no longer should perversely subsidized fossil fuels hold our welfare to ransom. More so, dependence on a few countries for energy and fertilizer needs poses exceptional and unacceptable risks. In the short- to medium-term, import diversification is sorely needed, while a process to begin repurposing fossil fuel subsidies towards increased investment in renewable energy and the manufacture of bio-fertilizers, such as green ammonia (N) as well as biochar, should be incentivised for urgent investment and hence implementation.

The diversion of food supplies to an unsustainable livestock sector, contributing to exceptional levels of greenhouse gas emissions, as well as to the bio-fuel sector needs a complete rethink in such times. Indeed, an alarming 58 percent of global cereal utilization is currently destined for non-food use. Equally, the overuse of mineral fertilizers needs to be addressed, especially due to its role in creating additional input demand, higher prices as well as compounding environmental degradation.

Yet, there are proven solutions available that can have immediate impact. For example, the cultivation of legumes (intercropping or in rotation with cereals) has soil N-fixing properties, a practice that has been known for almost two centuries. Farmers can also learn much from the forestry sector, in that growing crops



within orchards or trees – agroforestry – improves soil fertility by increasing organic matter, boosting microbiological activity, mineralizing nutrients into a more plant-available form, cycling nutrients up from deep soil layers to shallow ones, fixing nitrogen (in the case of leguminous trees), and preventing nutrient losses due to leaching, erosion and runoff. Also, organic fertilizers derived from multiple sources (e.g., manure, urban waste) not only constitute a highly effective near-term solution, but organic fertilizers are integral to the circular economy – an increasingly important model for planetary sustainability.

The world can take comfort from the responses to the Covid-19 crisis, in which scientists came together to develop vaccines in unprecedented time, which has helped to contain the serious effects of the pandemic. In a similar vein, such rapid response should

be targeted to transforming the global food system towards a sustainable and resilient path – in which the system is decoupled from exposure to the shocks of today. A crisis-free food system would guarantee the food security of all in the years to come. But we cannot turn a blind eye to what could transpire in the current and next crop seasons. The prospect of famine looms on the horizon. To prevent this prospect, the world should release food and fertilizers from its stockpiles and distribute them to those countries most at risk of famine. Feeding people first and sharing grains before producing biofuels and meat is an available solution to avoid a possible global hunger crisis. And it would build up trust especially between developing countries in need and the G7. And trust is also a very scarce resource in the world of today.

We must prepare for what lies immediately ahead, so that the multilateral system can initiate whatever measures, no matter how extreme, to avert famine. De-risking complex food systems towards sustainable transformation is an utmost imperative. But the most pressing immediate issue is to undertake a deeper assessment of how mineral fertilizer application shortfalls will threaten food security, which could bring about high mortality and civil unrest in the years ahead. Finally, there is an urgent need to re-assess the readiness of the global governance system to bring about meaningful and concerted action. The G7 has made some promising steps in this regard.

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DOI: <https://doi.org/10.35435/2.2022.4>

This publication was made possible with the financial support
by the German Federal Ministry for Economic Cooperation and
Development (BMZ).

