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Shocks and Disruptions

The Relationship Between Food Security and National Security

By George Grant

Foreword by the Rt Hon Sir Malcolm Rifkind MP

About the Author

George Grant is a Research Fellow at The Henry Jackson Society, which he joined in October 2009. George has written extensively for HJS on a wide range of issues relating to British foreign policy and international relations, with major recent publications including "Succeeding in Afghanistan" (September 2010) and "The Tipping Point: British National Strategy and the UK's Future World Role" (July 2011). Since February 2011, George has worked closely on the conflict in Libya and the country's subsequent efforts towards democratic transition. He writes frequently for mainstream national and international newspapers including the Daily Telegraph, the Guardian and the Wall Street Journal Europe, and regularly appears on TV and radio news outlets including the BBC, Al Jazeera, Channel 4 News and Sky News.

A frequent speaker on foreign policy and defence issues, George has given briefings to senior officials at the Foreign & Commonwealth Office, the Ministry of Defence, the Stabilisation Unit and lecturers at the Royal Military Academy, Sandhurst. George has an MA (Hons) in History from the University of Edinburgh, and an MA (Dist.) in Investigative Journalism from City University, London.

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Food is one of mankind's most basic needs, and inadequate provision is a tragedy for hundreds of millions of people living in the developing world. Yet the importance of the world's food supply extends far beyond the threat of shortages, hunger and poverty. The availability and cost of food affects many areas of domestic policy, as well as national and international security.

This wide-ranging and comprehensive report attempts to address the challenges that flow from a supply chain that is under increasing pressure. Chief among them is the need to increase agricultural productivity, reduce food waste, and improve distribution networks. Such steps must be prioritised if production is to keep pace with the demands of a world population set to exceed 9 billion by 2050.

Consideration is also given to the increasing cost of food. Recent spikes in commodity prices have exposed the fragility of the world's food production base, and the precarious balance between supply and demand. Rising prices have an effect on the health of the UK economy, as well as political stability in foreign countries. As the Arab Spring has demonstrated, countries that are economically weak are acutely vulnerable to fluctuations in cost.

This report also makes an important evaluation of the domestic agricultural sector, and the security of the UK's food supply. While the UK and Europe are world leaders in production, the food chain resilience must be kept under constant review in an age of 'just-in-time' delivery models.

The Crop Protection Association is to be congratulated for commissioning a thought-provoking study, and George Grant of The Henry Jackson Society should be commended for producing a readable and timely evaluation of this topic.

Crop Protection Association

Message from the Crop Protection Association

At a time of heightened concern over the combined impact of population growth and climate change on food prices and availability, this groundbreaking report by The Henry Jackson Society highlights the very serious risks – in socio-economic, geo-political and humanitarian terms – of failing to tackle the global challenge of food security.

The immediate economic consequences of food insecurity are well-documented. In the industrialised world, higher food prices would lead to increased pressure on disposable incomes with damaging impacts on the wider economy, while consumers on lower incomes would also suffer a reduction in the health benefits associated with a wide choice of affordable fresh fruit and vegetables. In developing countries, food shortages and higher commodity prices would threaten the pace of development and lead to increased hunger and malnutrition in the world's poorest regions.

Central to the report's economic conclusions is a clear signal that access to the most advanced farming technologies will be needed to ensure global food production can keep pace with burgeoning demand, while keeping the lid on food price inflation and providing the raw materials to safeguard jobs, growth and wealth creation within the rest of the food chain.

But in examining the relationship between food and national security, this report also highlights the wider, devastating consequences which can be linked to disruptions in global food supply, from human conflict and civil unrest to trade disruption, mass migration and the threat of agro-terrorism.

The report singles out the EU as one of the world's major food producing economies, with significant capacity to influence global food prices and availability, but warns that Europe's leaders are at risk of sleepwalking into a food crisis unless current policies to restrict production-boosting agricultural technologies are reversed.

Innovation in plant science, for example, from agricultural biotechnology to novel crop protection products, offers major opportunities for Europe's farmers to deliver sustainable gains in agricultural productivity. Yet such advances are discouraged by an antiscience EU policy agenda.

The Crop Protection Association is pleased to support this report as an important contribution to the food security debate. Above all, we welcome the report's clear message to policy-makers of the urgent need to embrace developments in agricultural science and innovation, not only to stave off global hunger and economic hardship, but also to mitigate the threat of food-related terror, war and human suffering.

Dominic Dyer. Chief Executive, Crop Protection Association

Executive Summary

WHY FOOD SECURITY MATTERS

The UK government has estimated that by 2050 the world will need to produce 70 per cent more food than it does today. This will put considerable pressure on already strained agricultural resources.

However, food security also matters for a range of reasons other than ensuring that the world's population has enough to eat. These include:

THE IMPACT OF RISING FOOD PRICES ON UK AND GLOBAL ECONOMIC GROWTH

Between July 2010 and July 2011, the average UK food bill went up by 5.2 per cent. The Food & Agriculture Organisation has predicted that global food prices will rise by an additional 20 per cent by 2020. Rising food prices will reduce the amount consumers spend in other sectors of the economy, further threatening an already-halting economic recovery.

An additional concern is that consumers respond to rising prices by compromising on the quality of food they buy. Low-income households already spend an average of 15.8 per cent of their income of food, and rising food prices will make it more difficult to maintain healthy diets.

Food-price inflation also represents a significant threat to the economic health of major emerging economies such as China and India, with the potential to slow economic growth internationally. The UK has a key role to play in addressing the challenge, both independently and in concert with its European partners.

FOOD SECURITY AND THE EUROPEAN UNION

The European Union (EU) is the world's third largest producer of cereals and the second largest producer of livestock. The import and export value of European agricultural products remains the highest in the world. As a leading force in the formulation of global agricultural policy, the EU retains the capacity to influence global food prices.

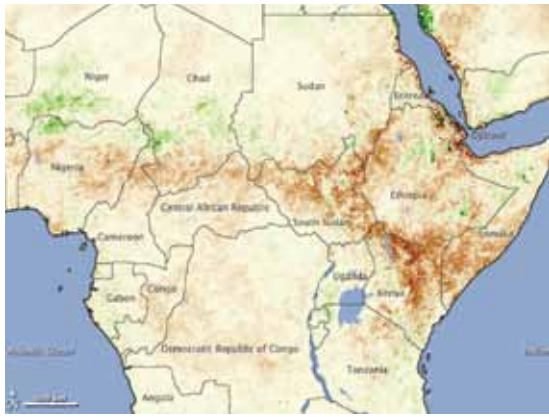
European agricultural policy in areas such as the production of biofuels or the regulation of genetically modified (GM) food does not just impact on European consumers, but also on consumers well beyond Europe's borders. Biofuel targets have been linked to global food price inflation and represent a real threat to global food security. Strict prohibitions on the cultivation and import of GM foods inside Europe are working against the interests of farmers in developing countries which depend on the European agricultural market, and are consequently denied access to technologies that could protect crops and enhance yields.

FOOD SECURITY AND CONFLICT

The relationship between food security and conflict is significant. There are currently 60 countries in the world ranked as having an "Extreme" or "High Risk" of food-related insecurity, with the majority of these countries located in underdeveloped regions where economic and political breakdown is advanced.

In 2008-09, food insecurity contributed to revolutions that deposed the governments of Haiti and Madagascar and cost dozens of lives. In Darfur, food and water-related conflict has left 500,000 people dead and generated 2 million environmental refugees.

Most recently, food insecurity has been identified as a contributory factor to the uprisings that have swept across the Middle East and North Africa. For a globalised trading nation such as the UK, conflicts overseas can and do jeopardise British interests, disrupting trade, creating refugees and incurring expensive post-conflict reconstruction. Moreover, the conflict in Libya has demonstrated that food insecurity - even when indirect - can contribute to developments that result in a British military response.



THE IMPACT OF SHOCKS AND DISRUPTIONS ON THE UK FOOD CHAIN

The government has assessed the UK's food security as high. The size and diversity of the UK food industry makes it relatively resilient to disruptions that could cause lasting damage. Nonetheless, the physical openness of the UK food-chain makes it vulnerable to targeted shocks, be they natural, accidental or malicious.

It is also important to note that the UK's food self-sufficiency has steadily declined over the past three decades. In 2010, the UK produced just 52 per cent of the food consumed, and had a self-sufficiency ratio of 60 per cent. In 1984, the UK's self-sufficiency ratio was 78 per cent, its peak following a steady recovery in the years following the Second World War.

In the past two decades, the UK has suffered several shocks to its food chain which between them have cost the British economy £15 billion and directly led to the loss of 630 lives.

The Centre for the Protection of National Infrastructure (CPNI), along with a number of other industry-experts, has

warned that the UK food-chain is also vulnerable to agro-terrorist attacks. The physical openness of most farmyards; the concentrated and intensive nature of contemporary farming practices and the fact that vetting procedures for farm workers are almost non-existent, make the food-chain potentially vulnerable to attack.

CRITICAL AREAS FOR FURTHER CONSIDERATION

In order to mitigate these risks and improve both national and global food security, the following areas should be afforded serious further consideration:

BIOFUEL TARGETS

Over the next decade, the international drive to meet biofuel targets could inflate food prices by as much as 40 per cent. In its assessment of the 2007-08 food price spike, which saw global food prices rise by 63 per cent, the UK government concluded that the diversion of agricultural land to biofuel production was a significant contributory factor.

If biofuel targets are not to be scrapped altogether, they should at least be more flexible, with one possibility being to specify a relationship between the Food Price Index (FPI) and the diversion of biofuel feedstocks back into the food chain.

EU REGULATION OF CROP PROTECTION PRODUCTS

Crop protection products are vital to guarding crops from the pests and disease that currently account for an estimated 40 per cent loss in the global production of food. Despite this fact, the EU is committed to reducing the use of crop protection products, a policy that is hurting farmers and having an adverse impact on crop yields and prices. The government's Chemicals Regulation Directorate has estimated that the EU's latest pesticide directive could cut crop yields by as much as 20 per cent.

Regulation of crop protection products is very important, particularly where

they pose a risk to human health or the environment. However, current regulation is driven by perception of hazard, rather than scientific evidence of risk. The EU needs to revisit its regulation of crop protection products to ensure that regulations in this area are science based, enabling and proportionate.

EU REGULATION OF GENETICALLY MODIFIED ORGANISMS (GMOS)

For many years, European public opinion has been suspicious of GMOs and the risks they could pose to human health. However, recent studies by both the Royal Society of Medicine and the European Commission Directorate-General for Research indicate that GMOs have been consumed by millions of people worldwide for over 15 years with no reports of ill-effects. Not only that, but data from the International Service for the Acquisition of Agri-biotech Applications (ISAAA) has concluded that GMOs have generated significant environmental and economic benefits over the past decade-and-a-half.

In spite of this, the EU's approach to GMO regulation is driven as much by politics and perception as by empirical scientific evidence. The UK government's official stance is that GMO regulation should be a science not politics-led process. The government should therefore work with likeminded EU member states to reform the approvals process to bring GMO regulation in line with the available scientific evidence and enhance global food security.

AGRICULTURAL TARIFFS & EXPORT REFUNDS

Agricultural protectionism has long been a contributing factor to high global food prices and food insecurity. When Russia, the world's third largest wheat exporter, imposed a grain export ban in August 2010, the result was a surge in global wheat prices, which drove up global food prices by 5 per cent. When Russia lifted the embargo in May 2011, wheat prices dropped almost immediately by 5 per cent.

Agricultural tariffs in the EU are on average three times higher than the average across industrial goods, and certain key commodities are protected by tariffs of over 70 per cent.

Unfortunately, efforts to globally reduce tariffs at the World Trade Organisation (WTO) have stalled since 2008 and it is difficult to see how a balanced and equitable reduction of tariffs will be achieved at the global level until those efforts resume. This also applies to the elimination of export refunds, although the EU has reduced these significantly in recent years.

THE COMMON AGRICULTURAL POLICY (CAP)

Although itself a form of agricultural protectionism, the Common Agricultural Policy (CAP) should not be scrapped. Instead, the CAP must be orientated decisively towards maximising production and eliminating the subsidisation of waste. Ensuring that the UK farming industry can continue to provide for the British people is a strategic *sine qua non*.

Certain objectives contained within the latest CAP reform proposal for 2013 should be supported, including doubling the budget for agricultural research and innovation, and facilitating the development of young farmers.

Other proposed measures should be abandoned, in particular the efforts to reintroduce Set-aside, this time for ecological purposes, and a proposal to make 30 per cent of direct support to farmers contingent upon mandatory environmental criteria. The EU is right to maintain environmental regulations, but the CAP should not be one of them.

UK RESEARCH & DEVELOPMENT (R&D)

When the Green Revolution transformed global agriculture 50 years ago, it did so

with innovation and technology, not through the cultivation of significant quantities of new land. Over the next 50 years, the world will need a second Green Revolution, with demographic and environmental constraints meaning that there will be even less new land available for cultivation this time.

However, since the mid-1980s, the UK government has reduced its support for agricultural research and development, and agricultural productivity has suffered accordingly. Not only have total productivity increases declined relative to other leading European countries, there are fewer scientists involved in agricultural research, and those who remain are getting older.

The UK government must recognise that retaining its status as a world-leader in innovative research is important not just for UK food security, but also in light of the relative decline of a number of other sectors of the economy.

THE RELATIONSHIP BETWEEN FOOD SECURITY, FOREIGN POLICY AND DEVELOPMENT POLICY

It has been estimated that the world already grows enough food to feed 11.5 billion people. The problem is that whilst some people have more than enough, others have far too little. Improving distribution is important, but practical constraints, not least the need to minimise food price rises mean that this cannot be the whole solution.

Perhaps the most significant cause of food insecurity and lack of access to food is poor governance and state failure. The world's hungriest states are also amongst its worst governed. It is no coincidence that Israel has the same level of food security as Portugal and Spain, but just half the annual rainfall of Ethiopia.

Although UK agricultural development assistance can and does save lives in the short-term, in the long-term it will fail if not accompanied by concomitant efforts to improve governance and security in countries of concern—goals which must be reflected in the UK's foreign and development policies.

FOOD WASTE

Across both the developed and developing worlds, some 30-50 per cent of all food produced is never consumed.

In the developing world, most food is wasted before it reaches the consumer. Inadequate anti-pest safeguards such as proper silos account for significant loss, whilst poor road infrastructure and lack of proper refrigeration leads to goods spoiling whilst in transit. Adverse weather conditions and disease can also have a significant impact. The government needs to support efforts to improve physical infrastructure, as well as help increase the availability of much-needed agricultural technologies. Addressing governance deficiencies that perpetuate these failures in the first place is crucial.

In the developed world, most waste occurs after food reaches the marketplace. The main problem is behavioural, and awareness campaigns to change attitudes have a part to play. However, the impact of such initiatives will always be limited compared to changing economic incentives, which represent the most influential drivers of change.

The UK should also improve in making use of that food which would otherwise be wasted. Food banks, which redistribute retailer food waste to those in need, are one example. However, the EU also needs to revisit legislation which prohibits the majority of food waste being fed to livestock.

EMERGENCY FOOD RESERVES

Internationally, food reserves are in decline, and in recent decades have tended towards an increased reliance on imports from global markets to meet food needs. In 2010-11 alone, global cereal stocks declined from 534 to 490 million tonnes. Objections to national food reserves are that they distort market prices and are expensive to maintain. The UK does not currently hold any food reserves of its own.

The World Food Programme (WFP) possesses limited grain reserves, and the WFP estimates it feeds more than 90 million people every year. Institutionally, however, the organisation is reactive, not proactive. The WFP needs reform to enable it to adopt a more forward-looking approach, where action can be taken in anticipation of a crisis, and not just after one has hit.

An initiative currently being trialled in West Africa in response to the 2007-08 food price spike could serve as a useful model. Rather than distributing food as disaster-relief, this proposal involves holding reserves of food that can be purchased by eligible states at the lower end of the food price index in the event of sudden price rises or fluctuations.

UK FOOD-CHAIN RESILIENCE

Although UK food security is assessed as high, the food chain is vulnerable and measures to increase resilience should be encouraged. Broadly, there are three levels of resilience: First, identification of potential threats and development of contingency plans; second, investment in community resilience to respond to those shocks that are not foreseen or prevented; third, "adaptive resilience", which involves drawing on past experience when upgrading or replacing physical infrastructure and logistics networks.

The Centre for the Protection of National Infrastructure (CPNI) has produced extensive advice for the food industry on how to minimise the threat of disruption to their services. These recommendations are only advisory in nature, however, and available research suggests the food industry prefers to operate on a 'just-in-time' as opposed to a 'just-in-case' basis.

The government should enhance efforts to raise awareness of the importance of resilience amongst the agricultural industry, and consider both financial and legal measures to improve and support compliance. Any reforms must achieve a balance between increasing resilience and ensuring the competitiveness of the UK food industry.

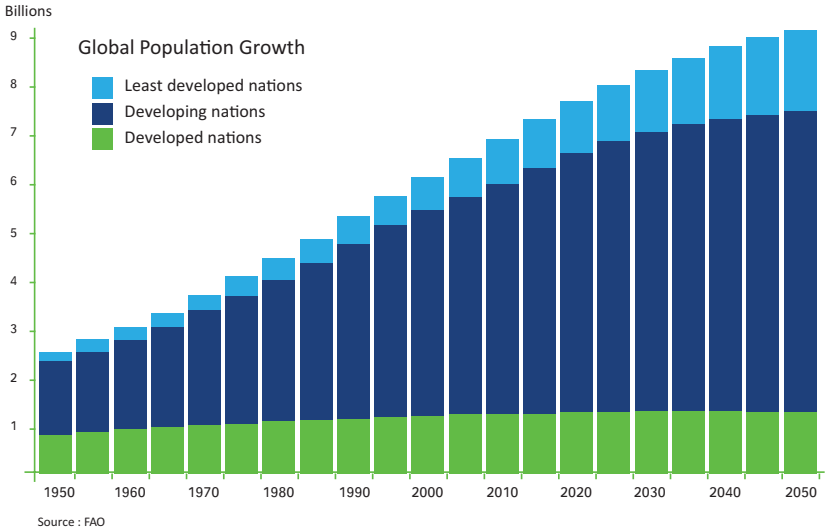
Introduction

Over the past three decades, Western nations have not struggled to feed themselves. On the contrary, at least insofar as feeding Westerners is concerned, they have produced too much. For much of the rest of history, and still in many developing countries today, the opposite has been the case. There are two primary causes for people going hungry. The first of these is when demand outstrips supply; when there are more mouths to feed than there is food available to feed them. The second is when the means of distribution fail; when food enough exists, but it does not reach those who need it.[i]

Over the coming decades mankind is going to be confronted by both these challenges in a major way. Between 2012 and 2050 the world's population is expected to increase from seven billion to nine billion, a rise of more than 140,000 people per day. Not only will farmers need to grow more food, they will need to do so in a sustainable way at less cost to the environment, with climactic changes themselves contributing to growing food insecurity in many parts of the world. According to the UK government's Foresight report on Global Food and Farming Futures, in order to adequately meet rising demand, the world will need to produce 70 per cent more food by 2050 than it does now.[1]

This task will be further complicated by a number of additional and inter-related challenges, including an expanding demand for more resource-intensive food; rising energy prices; slowing growth of yields; policies driving growing demand for biofuels; a potential failure to exploit agricultural technologies such as crop protection products and genetically modified organisms (GMOs); crop shortfalls from natural disasters; increasing land and water scarcity; and protectionist policies that restrict supply and drive up the price of food.

i. The most well-known of all expositions on the first of these two problems is *An Essay on the Principles of Population*, penned by the 18th century English scholar, the Reverend Thomas Malthus, in 1798. In his essay, Malthus famously predicted that periodic starvations must necessarily occur because "the power of population is indefinitely greater than the power in the earth to produce subsistence to man". Perhaps the most famous proponent of the second problem - that of distribution failures as the primary challenge to be overcome - is the Nobel Prize-winning Indian economist, Amartya Sen. In his essay *Poverty and Famines*, published in 1998, Sen argued that policy decisions have a greater role in causing mass starvation than food shortages. Citing the 1943 Bengal famine, in which three million died, Sen pointed out that food was actually being exported throughout this period. What really caused the famine was a lack of access, be that in terms of affordability or physical access to food.



For significant numbers of people across the developing world, food security remains a day-to-day issue of life or death. Although that is not the case for British citizens living in the United Kingdom, there are nonetheless a number of other ways that food security can and does impact on the UK and its interests.

According to current figures, the UK is one of the few developed countries with a population that is expected to expand significantly over the next few decades. According to the US Population Reference Bureau, the UK population is predicted to grow to 77 million people by 2050, from 62.2 million now, surpassing France and Germany to become the most populous country in Europe.[2] At the same time, the UK is becoming increasingly dependent upon food imports, with UK food self-sufficiency continuing the decline that began in the mid-1980s. In 2010, the UK produced just 52 per cent of the total amount of food it consumed, and had a self-sufficiency ratio of 60 per cent[ii].[3] In 1984, the UK's self-sufficiency ratio hit a peak of 78 per cent, following a steady recovery in the years following the Second World War.[4] This demonstrates the complacency with which policymakers have viewed food security in the UK, which has increased the country's vulnerability to shocks and fluctuations in a highly uncertain global food market.

The days when the UK and Europe produced too much to eat, to the point where policymakers paid farmers not to produce food, are gone. For some 30 years, between the mid-1970s

ii. The difference between the amount the UK produces as a proportion of what it consumes, and overall self-sufficiency, is that the latter includes food produced for export which could be diverted to domestic use should the need arise.

and the mid-2000s, the price of food steadily declined.[5] The industrialised world literally reaped the benefits of technological advances made during the so-called Green Revolution, turning Malthusian predictions that food production could never keep pace with population growth on their head. That changed abruptly in 2007 with the onset of a price-spike that saw food prices rise by more than 63 per cent in just 18 months. These prices briefly dropped back to pre-2007 levels in the latter half of 2008 and early 2009, before rising and then beginning a second spike in 2010-11.[6] According to the UN Food & Agriculture Organisation (FAO), this trend is set to continue in the coming years. The current FAO forecast for 2011-2020 predicts that cereal prices will be on average 20 per cent higher by 2020 than they are now, and meat prices 30 per cent higher. Depending on variables including yield growth and the price of oil on world commodity prices, this increase could be higher still.[7]

Much has been written in recent years about the interconnected challenges of how to feed the world in the coming decades. However vital this question may be, food security is about much more than ensuring that the world's poorest people have enough to eat. The purpose of this report is to highlight some of the other key reasons why food security represents one of the most significant challenges of our time.

The report is divided into two sections. Section one deals with some of the primary reasons why food security matters, including:

- The impact of rising food prices on UK and global economic growth;
- The importance of the European Union (EU) as a global food producer and shaper of international agricultural policy;
- The interrelationship between food insecurity, conflict and revolution,
- The impact of shocks, whether malicious, natural or accidental, on the UK food chain.

The second section of this report highlights a number of critical areas for further consideration by both policymakers and industry experts if UK and international food security deficiencies are to be successfully addressed.

Why Food Security Matters

FOOD SECURITY AND THE ECONOMY

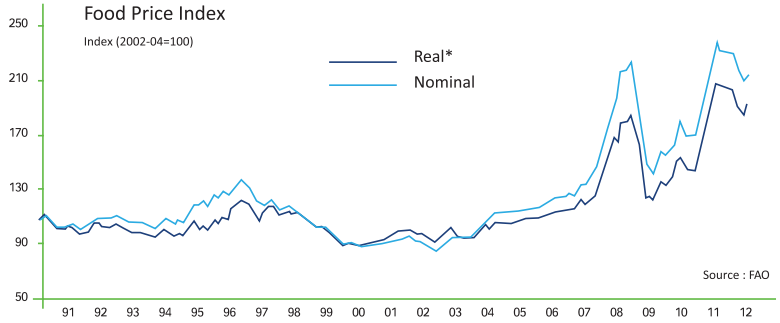
IMPACT OF RISING FOOD PRICES ON UK ECONOMIC GROWTH

One of the most serious corollaries of the increased pressures on the world's food supplies is rising prices. Inevitably, those hit hardest by higher food prices will be the poor in developing countries, but they are not the only ones who will be affected. British policymakers should also be concerned by this trend because of the detrimental impact that rising food prices have on economic growth, both in developed and developing economies. Rising food prices have the potential to jeopardise an already fragile economic recovery in the UK and internationally.

According to the government's 2010 Family Food Survey, households spend an average of £24.50 per person per week on food, which equates to £1,274 per annum per person.[8] Thus a family of four is now spending over £5,000 a year on food. On average, 11.5 per cent of household spend is now allocated to food, rising to 15.8 per cent for low-income families.[9] Between July 2010-11 alone the average food bill in the UK went up by 5.2 per cent, as average household incomes stagnated.[10] If food prices were to rise by an additional 20 per cent, as the FAO has predicted will occur, this would put significant extra strain on already squeezed budgets.

Such developments constitute a real concern, not least because economic growth forecasts in the UK remain extremely poor, with the ongoing Eurozone crisis introducing the possibility of a second recession. The UK economy shrank by 0.3 per cent in the last three months of 2011, a trend that may continue into 2012.[11] Simultaneously, the consumer price index of inflation continued to defy the Bank of England's 2 per cent target throughout 2011, peaking at over 5 per cent. [12] Although inflation has fallen back in line with the Bank's predictions since that time, it finished 2011 above 4 per cent and was still at 3.4 per cent in March 2012.[13]

Policymakers should be concerned about the impact of rising foodprices for two reasons. To begin with, many



*The real price index is the nominal price index deflated by the World Bank Manufacturers Unit Value Index (MUV)

families, already tightly-squeezed financially, will respond to an increase in food prices by compromising on the quality of food they buy. Those on lower incomes will be hardest hit by price rises and may find it more difficult to maintain healthy diets. Rising prices could also lead to stagnation in areas of the market focused on premium/niche foods, and values-based products (organic, fair trade and higher-welfare ranges).

Although this is a concern, there is good evidence to suggest that even during an economic crisis spending on food remains fairly consistent; it is spending in other areas which declines as a result. The validity of this concern appeared to have been borne out by half-year sales figures released on 5th October by Tesco, the UK's largest supermarket, which retains more than 30 per cent of the country's total market share. Posting its worst performance for 20 years, Tesco highlighted weakened demand for non-food items, including electronics and entertainment products. Significantly, however, the supermarket reported that like-for-like sales in food were *"positive and showing signs of improvement".*[14] However, Tesco's January 2012 trading statement, reported a 1.3 per cent decrease in like-for-like sales.[15]

Indeed, analysis by the Institute for Fiscal Studies (IFS) maintains that unlike in previous recessions, food purchases are in fact falling significantly, which may reflect sharp increases in the price of food. In a study released on 17 October, the IFS reported a 6.6 per cent drop in food purchases over the course of the current recession.[16]

It is by no means inconceivable that some consumers will respond to rising food prices by cutting back their spending on food, whilst others will choose to reduce spending in other areas. Either way, significant increases in food prices at a time of stalling incomes and rising unemployment can only add strain on an already weakened UK economy. As the Office for Budget Responsibility (OBR) warned in March 2011, if oil and food prices continue to rise, then so will inflation: "*Under the assumption that wages don't adjust to this, consumption will fall and growth will be lower".*[17]

IMPACT OF RISING FOOD PRICES ON THE INTERNATIONAL ECONOMY

Today, the major engines of global economic growth are to be found in Asia, in particular China and – to a lesser but nonetheless significant extent – India. As UK economic growth struggles to reach 1 per cent, China posted growth figures of 8.9 per cent in the final quarter of 2011 alone,[18] whilst India finished the year with quarterly growth of 6.1 per cent.[19] As the Governor of the Bank of England, Mervyn King, asserted in a speech on 18th October 2011, *"Our fate rests to a considerable extent on the policies pursued by our trading partners".*[20] For the European Union, both China and India are two such indispensable trading partners[iii].[21]

Should the economic growth of these two major economies slow considerably, that would certainly jeopardise the EU's faltering economic recovery, if not the fate of the entire global economy. Higher food prices represent just such a threat to both countries.

In addition to ongoing economic turbulence within Europe and the United

iii. China is the EU's most significant import partner and its third most important export partner after the United States and Switzerland. Likewise, the EU represents China's most important export partner and second most significant import partner after Japan. From the Indian perspective, the picture is clearer still: The EU is its most important export and import partner bar none. (Source: World Trade Organisation)

States, high levels of inflation have negatively affected both China and India in recent months. Though still impressive when compared to Western growth figures, China's growth declined by almost one per cent last year, down from 9.8 per cent at the end of the first quarter of 2011.[22] In March 2012, Beijing cut its annual growth target to 7.5 per cent for 2012.[23] Indian economic growth slowed considerably in 2011, its fouth quarter growth rate was the lowest in more than two years.[24]

Although inflation in China has fallen back from its 2011 high of 6.1 per cent, what has not changed is the disproportionate impact of food price inflation on the overall figure. Food constitutes the biggest part of China's CPI, with an estimated share of around 30 per cent, and back in September 2011, food price inflation was running at a dangerously high level of 13.4 per cent, more than double the overall CPI. That ratio continued into early 2012, with food price inflation running at 6.2 per cent, as against an overall inflation rate of 3.2 per cent. [25] In India food price inflation was running above 10 per cent in October 2011, and though it fell back to 6.55 per cent in early 2012 in response to a decrease in global food prices, food price inflation nonetheless poses a genuine risk to the country's economic future.[26]

Many of the causes of food price inflation in China and India are internal or environmental and consequently beyond the control of UK policymakers, at least in the short term. In the case of China, for instance, the wheat crop was badly affected in 2010-11 by extended droughts and severe floods. Environmental problems are further exacerbated by the fragmented nature of China's agricultural sector, which is comprised of millions of small farmers, making it more vulnerable to food price rises, and disproportionately prone to food price volatility. Half of China's population - some 674 million people - still live in the countryside. Many work in agriculture, and it is arguable that the vulnerable and rudimentary nature of their small plots leave them more susceptible to the fallout of changes in market prices, disease and adverse weather than large industrial operations, which still constitute only 20 per cent of the Chinese market.[27]

However, as with almost all countries, food prices inside China and India are also affected by international factors, over which British and European policymakers have considerable influence. Both countries rely on international markets to help meet their food needs—in fact, China is a net importer of food, and the burgeoning middle classes in both countries are demanding a more varied and calorific diet requiring a significantly increased supply of food to sustain.[iv] Both farmers and policymakers in the UK and EU will have a vital role in helping to meet that demand in the coming years.

iv. This is particularly apparent with regards to rising demand for meat, the production of which is much more resource intensive than crops. For example, between 1,150 and 2,000 litres of water are required to produce 1kg of wheat, but 16,000 litres are required produce 1kg of beef. In turn, 10kg of grain are required to produce 1kg of beef. According to the government's Foresight report on Global Food and Farming Futures, per capita consumption of meat is expected to grow from 32kg per capita today to around 52kg per capita by the middle of the century, and it is developing countries such as China and India that will account for the greatest share of that rise.

FOOD SECURITY AND THE EUROPEAN UNION

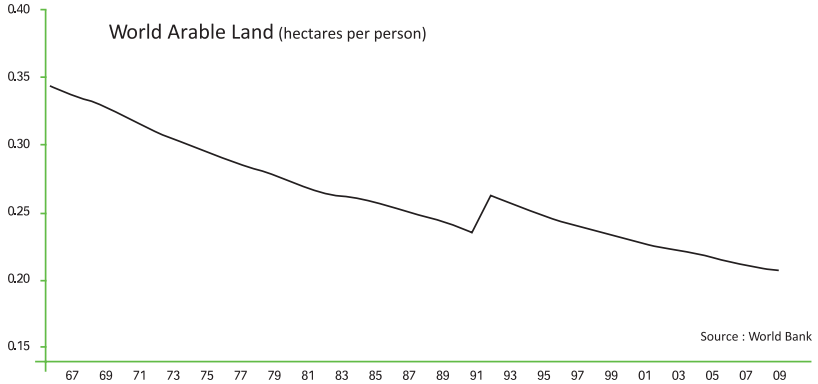
EUROPE'S SIGNIFICANCE AS A GLOBAL FOOD PRODUCER

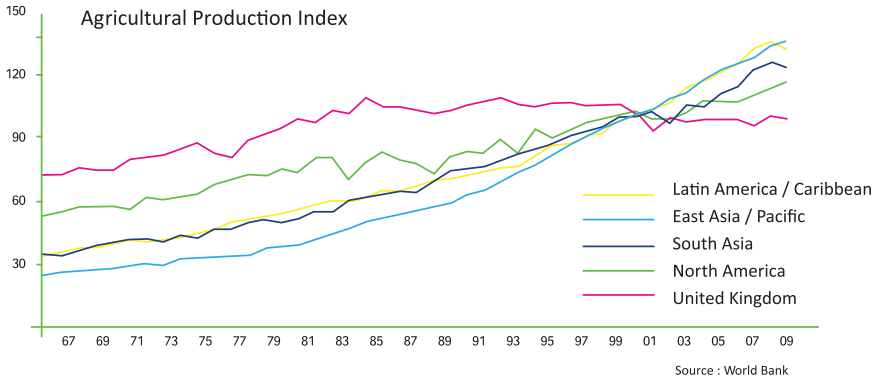
Today, Europe is a critically important food producer, whether in terms of the yields it achieves, the technologies it produces or the policies it pursues, all of which influence the agricultural industry internationally. The EU is the world's third largest producer of cereals, after China and the United States and the second largest producer of livestock after China. In terms of both the import value and the export value of its agricultural products, the EU remains by far the most important market.[28] As the Food and Farming Minister, Jim Paice MP, observed in October 2011, if the predicted impacts of climate change come to pass, northern Europe in particular will become an even more significant component of the world's food production base in the next half century.[29]

In terms of the yields they achieve, European countries continue to set an example that much of the rest of the world aspires to follow. As of 2009, average wheat yields across the EU were 5.2 tonnes per hectare, the highest in the world, and 7.7 tonnes in the United Kingdom. This compares to an average of 3 tonnes in North America, 3.2 tonnes in South America, 2.9 tonnes in Asia and 2.3 tonnes in Africa.[30]

The ratio of land availability relative to population size is equally significant in the context of food security. By this measure, the needs of South East Asia and the Pacific are most acute, as these regions possess just 29 per cent of the world's arable land, but 53 per cent of its population. Contrast this with the countries of the OECD, Europe and Central Asia, which between them account for 22 per cent of the world's population but 46 per cent of its arable land.[31] Taken in isolation, the EU possesses some 7.1 per cent of the world's total population and 8.1 per cent of its arable land.[32]

It is important to note that over the next 50 years population growth in Europe and the OECD countries is expected to largely stagnate, whilst developing countries, especially in South East Asia, will account overwhelmingly for the predicted 2 billion increase in the world's population, making Europe's contribution to food security even more vital. This reality is evidenced in the





contrasting international responses to the dramatic spike in the price of grains, rice and dairy products that took place in 2007-2008. While the global production of food increased by almost 4 per cent, significantly, this growth took place overwhelmingly in the developed world and the Commonwealth, with the rest of the developing world reporting no above-trend growth.[33]

This is why, even though European countries may feel content that they produce enough to feed themselves, that does not mean they can ignore their vital role in helping feed the rest of the world. This responsibility should be recognised as much more than just altruistic. As already mentioned, rising global food prices that result from supply failing to meet demand represent a real threat to the economic wellbeing of some of the world's major economies.

In addition to Europe producing enough food to help meet rising global demand, EU policymakers also need to recognise the impact that their agricultural policies can have well beyond Europe's borders.

THE IMPACT OF BIOFUEL TARGETS ON FOOD SECURITY

One area of EU policy that has adversely affected food prices is the drive to increase the use of biofuels. As part of a global effort to reduce dependence on non-renewable energy sources and combat climate change, the EU has committed itself to a mandatory 10 per cent minimum target to be achieved by all Member States for the share of biofuels in transport petrol and diesel consumption by 2020.[34] Brazil, Japan and Indonesia have likewise committed themselves to a 10 per cent target and China to a 5 per cent target. The United States has committed to meeting 30 per cent of its energy needs from renewable sources that include biofuels by 2030.[35]

Although these policies appear well-intentioned, the fact is that biofuel targets are placing unnecessary constraints on an already pressurised global food market and inflating prices significantly. According to a 2011 report by the World Bank, expanding biofuel production to meet the various national targets currently in place could push up global prices of corn and other major grains by 3 per cent by 2020, and the price of sugar by up to 8 per cent.[36] This may even be a conservative estimate: a recent report by the FAO estimates that unless a significant amount of extra

land is found for biofuel production, global food prices could be pushed up by anywhere between 15-40 per cent, should food-crop production remain stable.[37]

A major problem with biofuel targets is that the energy market is worth significantly more than the market for food, so that even relatively small targets translate into huge demand for crops. For instance, at the start of 2011, ethanol accounted for just 8 per cent of the US's fuel for vehicles, but consumed almost 40 per cent of its already enormous maize crop. If all the American maize required to produce this ethanol were instead used as food, global edible maize supplies would increase by 14 per cent.[38]

The impact of biofuels on food prices and food security is not just a problem for the future however; the impact is already being felt. In its assessment of the 2007-2008 food price spike, when global prices increased by more than 63 per cent in 18 months, the UK government concluded that the diversion of agricultural land to biofuel production was a significant contributory factor.[39] Likewise, the FAO has partly attributed the current increase in global food prices to biofuel production.[40] Ironically, a 2010 report sponsored by the European Commission has itself recognised the impact of biofuel expansion on crop prices, but noted this was a positive development when measured against the provided indicator of *"maintaining farm incomes".*[41]

THE IMPACT OF EU GMO REGULATIONS ON FOOD SECURITY

Another major area of EU policy that is adversely impacting global food security is the regulation of genetically modified (GM) food.

Opposition to GM food in Europe and the United States has a long pedigree, dating from the mid-1990s, when GM crops were first introduced to the food market. Initially, opposition was based upon fears that GM foods could be harmful to health, with pressure groups such as Greenpeace and Friends of the Earth warning consumers of the dangers of so-called "Frankenfoods".[42] In one memorable campaign, Greenpeace began running adverts featuring "FrankenTony", a monstrous imitation of Tony the Tiger, in protest at Kellogg's use of GM ingredients in their cereals.[43]

In response to widespread popular concern about the potentially adverse effects of genetically modified organisms on human health, the EU imposed a *de facto* ban on approvals of new GMOs in 1998, which was only lifted six years later in 2004. This decision was referred to the World Trade Organisation, which ruled in 2006 that the moratorium was a contravention of international trade rules.[44]

Currently, just two GM crops can be legally grown commercially inside the EU, a GM maize strain, Mon 810, authorised in 1998 and a GM starch potato known as Amflora, authorised for cultivation and industrial processing in March 2010.[45] Grown predominantly in Spain, Mon 810 is designed to be resistant to the European corn borer, which particularly affects maize crops in southern Europe. The maize is used primarily for animal feed, not human consumption. The Amflora potato, likewise, is not used for human consumption but industrial starch production. More than 20 other requests for authorisation of GMO cultivation, or for their renewal, are ongoing.[46] There are no GM crops currently grown commercially in the United Kingdom, since neither of the two approved products are of interest to UK farmers.[47]

Thirty-nine GM products were authorised for food/feed imports as of October 2011, although EU policy on the import of GMOs is by no means relaxed.[48] Until mid-2011, the EU had a zero-tolerance policy on the presence of unauthorised GM in animal feed imports. In countries such as Argentina or the United States, where GMOs are widespread in the food-chain, ensuring that food for export to the EU is entirely trace-free of GMOs has become increasingly commercially unviable. On 25 June 2011, however, the EU announced its decision to relax the zero-tolerance policy, agreeing a new 0.1 per cent limit on the presence of unauthorised GMOs in feed imports.[49] The EU still maintains the zero-tolerance policy on food imports intended for human consumption, however.

An increasing number of groups and individuals from both the scientific community and the food industry believe that the EU's continued resistance to GMOs is not only scientifically unsound, but commercially damaging to food producers in both the developed and the developing world. While it is only right that considerable care should be taken before introducing a genetically modified organism into an ecosystem, still more a human diet, over the past decade major studies have found no evidence that GM food does in fact harm health. A 2008 review by the Royal Society of Medicine noted that GM foods have been eaten by millions of people worldwide for over 15 years, with no reports of ill effects.[50] Likewise, a 2010 report from the European Commission Directorate-General for Research and Innovation determined that: *"The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology,*

and in particular GMOs, are not per se more risky than e.g. conventional plant breeding technologies".[51]

On the contrary, there is now good evidence to suggest that biotechnology, including GMOs, offer a range of benefits that have accrued from enhanced agricultural productivity. The International Service for the Acquisition of Agri-biotech Applications (ISAAA) has concluded that had the world not made use of biotech crops between 1996 and 2009, an additional 75 million hectares of conventional crops would have been required to produce the same tonnage of food, some of it on fragile marginal lands at risk of deforestation; 393 million kilograms (kg) of extra pesticides would have been required; and in 2009 alone, an additional 17.6 million kg of carbon dioxide (CO_2) would have been released into the atmosphere, the equivalent of 7.8 million cars. In terms of economic gains, biotech crops contributed to an estimated $65 billion in extra revenues at the farm level between 1996 and 2009 and contributed significantly to lowering global food prices.[52]

In response to such evidence, anti-GM

campaigners have undertaken a subtle shift in their campaigning. The emphasis is no longer on potential dangers to human health, but the supposed financial cost to poor farmers in the developing world and concerns over the emergence of "superweeds". The belief that GM crops benefit large corporations at the expense of small farmers is one of the most pervasive arguments made by opponents of GM crops. In fact, prior to their cultivation being legalised, small farmers in developing countries such as Brazil resorted to smuggling GM seeds onto their farms in a bid to remain competitive internationally.[53] Today, 90 per cent of GM crops are grown not by big corporations but by small farmers in developing countries.[54] According to Dr Nina Fedoroff, who served as the US State Department's chief Science and Technology Adviser between 2007 and 2010, anti-GM policies may actually benefit large corporations at the expense of small farmers:

"The continuing distaste for [genetically engineered plants] and their consequent absurd over-regulation means that the most up-to-date, environmentally benign crop protection strategies are used almost exclusively for the mega-crops that are profitable for biotech companies. The public agricultural research sector remains largely excluded from using modern molecular technology."[55]

At a time when yield growth is slowing, demand for food is rapidly increasing, and prices are rising, the EU's continued resistance to GMOs is compromising both regional and international food security. Within Europe, GMOs are being developed that are both pest-resistant – thus reducing the need for pesticides – and capable of delivering enhanced yields. For instance, the John Innes Centre in Norfolk is currently conducting research on GM potatoes to make them resistant to a particular blight pathogen called *Phytopthora infestans. Phytopthora* is an especially harmful blight that has evolved to elude hundreds of natural resistance genes present in most cultivated potato varieties, and which causes some £3.5 billion in annual losses worldwide. The blight-resistant potato currently being trialled at the John Innes Centre reduces the amount of pesticides the crop needs whilst retaining all the characteristics that the market values in potatoes.[56]

Beyond Europe's borders, the EU's GMO policies are having a significant and, in many cases, detrimental impact on food security. Partly as a consequence of EU GMO regulations, many non-European governments have adopted anti-GMO policies, both because of the EU's importance to them as an export market and out of a desire to emulate European 'best practice'. The deleterious effects of this trend have manifested most acutely in Africa. Over the past 40 years, global food production has increased by 145 per cent, yet African food production dropped by 10 per cent over the same period. A mixture of political and environmental problems contributed to this outcome, with the consequence that many countries in Africa are unable to feed themselves. According to the FAO, just 4 per cent of African land is irrigated, and almost 240 million of the continent's 760 million people are going hungry.[57]

Although Africa's food insecurity will never be resolved without substantive political reforms, GM crops could have an important role to play in reducing hunger and increasing food security for the millions of people suffering from failures beyond their control. For instance, the Kenyan government is currently working with the Bill & Melinda Gates Foundation to support scientists in developing a nutritionally-enhanced GM sorghum crop. Sorghum is favoured by communities in some of the most arid regions of Africa, for instance in northern Kenya, because it is heat tolerant and requires very little soil moisture to grow. Its major drawback, however, is that it possesses almost no vitamins, making it an unhealthy diet on which many communities are nonetheless compelled to rely.[58] On 1st July 2011, the Kenyan government, in response to rising prices and a growing body of evidence confirming the safety of GMOs, approved a law permitting the production and importation of genetically modified crops.[59]

However, Kenya is only the fourth of Africa's 54 countries to allow the full-scale production and importation of GM crops.[60] Most African governments remain deeply sceptical of GMOs, even when confronted with extreme hunger and even famines. In 2002, Zambian president Levy Mwanawasa famously rejected a shipment of food-aid from the US that contained GM-corn, despite facing a famine that threatened the lives of up to 2.4 million people. Mwanawasa insisted, *"I will not allow Zambians to be turned into guinea pigs no matter the levels of hunger in the country".*[61] The president's decision followed a letter signed by Friends of the Earth and 140 African community leaders to the US government warning of GM's potentially "chronic toxic effects" on human health, and highlighting the risk of cancer.[62] In recent years, EU policies on GMOs have provoked increasingly strong criticism in relation to their impact on the GM policies of many developing countries, especially those which depend upon the EU as an export market. In October 2011, the leading African scientist and former agricultural adviser to the Kenyan government, Dr Felix M'mboyi, went so far as to accuse the EU of indulging in *"hypocrisy and arrogance [that] comes with the luxury of a full stomach".*[63]

If rising global demand for food is to be met in coming years, it is vital that Europe produces enough to feed both itself and many beyond its borders. EU policymakers therefore have a responsibility recognise the impact that EU food regulations have internationally.

FOOD SECURITY AND CONFLICT

THE INTER-RELATIONSHIP BETWEEN FOOD INSECURITY, CONFLICT AND REVOLUTION

Not since the Swing Riots of the 1830s has Britain been confronted with major civil unrest connected to the price of food. In that instance the catalyst was the end of the Napoleonic wars and the introduction of industrial technology to the farming sector that combined to make food prices not too high, but too low for the large number of people still dependent upon agriculture for their livelihoods. Today, even with food prices rising to unprecedented levels, and a warning in March 2011 by a senior HSBC economist that this could indeed combine with other severe economic pressures and lead to food riots in the UK, civil unrest connected to the price of food remains improbable.[64]

Nevertheless, for a deeply globalised country such as the United Kingdom, the threats posed by food-related conflict abroad should be a real concern. On 19th July 2011, Germany's Permanent Mission to the United Nations sought to include food security on the agenda of the UN Security Council, arguing that food insecurity *"can be both a cause and a consequence of violent conflict"*.[65] It is clear that the combination of expanding populations, rising food prices, climate change and forced migrations are poised to make food-related conflict a growing problem over the coming years.

According to the 2011 Food Security Index, produced by the global risk-analysis company Maplecroft, there are currently 60 countries in the world ranked as having an "Extreme Risk" or "High Risk" of food-related insecurity, 12 extreme and 48 high. Unsurprisingly, the majority of these countries are located in underdeveloped regions of the world where political and economic breakdown is advanced, with DR Congo and Somalia currently ranked the most at-risk countries on earth.[66]

Also at risk are a number of Arab states, including Egypt, Libya, Tunisia and Yemen, all of which experienced major upheavals in 2011. Longstanding economic and political motives for the so-called "Arab Spring" uprisings are well established; however there is evidence that rising food prices were another significant catalyst. A

September 2010 forecast by the Nomura Research Institute, which listed the top 25 countries most vulnerable to rising food prices, included Egypt, Libya and Tunisia.[67] In the 24 months preceding the outbreak of their respective revolutions, food prices rose by over 32 per cent in Egypt and almost 11 per cent in Tunisia.[68] The first protests of the Arab Spring, which hit Tunisia in December 2010, were dismissed initially as simply another round of bread riots, and a number of regimes responded by making adjustments to food prices and offering increased subsidies.[69]

A recent study by the New England Complex Systems Institute has posited that there is a figure above which food price riots and unrest become far more likely. That figure is 210 on the FAO's food price index (FPI), passed near the outset of the most recent food price spike in mid-2010, and which remained above 210 throughout 2011.[70] Whether such a concrete figure can be used in this way is open to question, but it nonetheless seems highly plausible that longstanding grievances including political repression and economic immobility, when combined with immediate additional problems such as the rapidly rising price of food, can and do lead to unrest such as has been seen across much of the Middle East and North Africa (MENA) in 2011.

The MENA uprisings are by no means the first upheavals to have taken place in recent years in which rising food-prices may have been a significant contributing factor, nor are they likely to be the last. The food-price spike of 2007-2008 saw the FAO index rise from 130 at the start of 2007 to over 210 by mid-2008, and the price increase[71] contributed to the collapse governments in Haiti and Madagascar. In Haiti, the government fell on 12 April 2008 when senators fired the prime minister after more than a week of riots over food prices, in particular the price of rice, which left five people dead, including one UN peacekeeper.[72] In Madagascar, spiralling rice prices also helped contribute to the 'direct expression of democracy' which cost 135 lives and saw the incumbent president Marc Ravalomanana replaced by the then-mayor of Antanarivo, Andy Rajoelina, in early 2009.[73]

Although not the primary focus of this report, another serious and interconnected concern that will undoubtedly generate additional conflict in the coming decades is water insecurity. It has been estimated that by 2050, humans will be consuming as much as 90 per cent of the world's freshwater supply, up from 54 per cent in 2009.[74]

Increased competition for dwindling resources has already generated major conflict in recent years, with perhaps the most brutal example in the Darfur region of Sudan. Although the conflict began as a regional rebellion in 2003, tensions escalated in part due to competition over water supplies driven by drought. Over the previous 40 years, a drop in rainfall of between 16-30 per cent shifted the desert boundary by 60 miles, prompting nomadic tribes to go after the territory of sedentary farmers for food

and water.[75] The resulting conflict was intensified by the fact that the people affected by these attacks accused the Sudanese government not only of failing to prevent these incursions by Arab nomads, but of supporting them. The government in Khartoum lacked the necessary infrastructure and will to respond to the crisis effectively, and instead recruited Arab militias known as the Janjaweed to wage a campaign of ethnic cleansing that cost 500,000 lives and generated 2 million environmental refugees.[76]

On 17th October 2011, the British Ambassador to Khartoum, Nicholas Kay, described Sudan as a country *"where hunger stalks the land".*[77] At a time when the international community struggled to feed 5.2 million Sudanese, Kay accused the government of preferring to *"sacrifice lives rather than sit around a table"*.[78] The remarks caused particular consternation in Khartoum, where the government fears another popular uprising. Sudan already experienced regular protests in 2011, as prices for staple foods rose by more than 20 per cent a month.[79] The Sudanese government has been accused of using food as a weapon of war against the newly-independent South Sudan, by blocking aid agencies during the pre-harvest lean season, and thus putting several thousand of its citizens at risk of starvation. [80]

In its most recent National Security Strategy (NSS), the UK government affirmed its commitment to prioritising 'upstream' conflict prevention, correctly recognising this as a far cheaper and more effective strategy than post-conflict reconstruction.[81] The government must recognise that measures to curb high and volatile food prices are a crucial component in that effort. Food-related conflict not only generates new refugee flows and potentially raises food prices further, it can even compel an international military response, which could implicate the UK. If rising food prices across the MENA region were indeed part of the catalyst that led to the uprisings in Tunisia and Egypt in early 2011, which in turn sparked the revolution in Libya, that makes them a component in the series of events which led to engagement of British forces in Libya as part of UN Security Council Resolution 1973. The fact that high food prices were almost certainly not on the minds of either Colonel Gaddafi or Prime Minister David Cameron when they considered their response to the crisis is immaterial; the fact is that they were a contributing factor, and one that sound policymaking and future planning needs to recognise and understand.

THE IMPACT OF SHOCKS AND DISRUPTIONS ON THE UK FOOD CHAIN

Although the UK carries a much lower level of food security risk than many developing countries, the British food chain is by no means invulnerable to shocks.

As with most sectors of the modern British economy, the food industry operates on a 'just-in-time' as opposed to a 'just-in-case' basis. The government holds no food reserves of its own, and overall reserves within the UK run to just a few days, consisting of whatever food remains unused within the food-chain at a given moment.[82] Over the past decade, the average stock of food held by British retailers has been in decline. In 1996, the average retailer stock of fast-moving groceries (perishables such as milk and bread) was 10.5 days; in 2008 it

was 9.5 days. Over the same period the average retailer stock of slow-moving groceries (non-perishable, non-frozen goods) declined from 13.5 days to 10.5 days, and the average stock of frozen foods declined from 12 days to 9.[83] Commercial pressures also demand that the food-chain be as lean as possible, and consequently dependent upon every section functioning properly.[84] Within that food chain, the UK has come to rely overwhelmingly on large supermarkets and their logistics networks. By its very nature, therefore, the British food-chain is vulnerable to shocks and disruptions, whether natural, accidental or malicious.

The UK food-chain is also vulnerable due to the openness, quantity and diversity of food production and distribution sites within the country. The threat of agro-terrorism in the UK is not widely recognised outside certain specialist sectors, but is an important component of UK food security requiring careful consideration by policymakers.

The government's Centre for the Protection of National Infrastructure (CPNI) identifies three main agro-terrorist threats to food and drink. First, malicious contamination with toxic materials causing ill-health and even death; second, sabotage of the supply chain leading to food shortage; and third, misuse of food and drink materials for terrorist or criminal purposes.[85] The CPNI maintains that 'upstream' attacks (i.e. disruptions at the production end of the food-chain), have the potential to cause much greater harm than 'downstream' attacks (i.e. disruptions at the consumer end of the food-chain),[86] as downstream attacks have a localised impact, whereas a successful upstream attack could percolate down into numerous other sectors of the food chain.

Sir David Omand, who acted as the UK's first Security & Intelligence Coordinator in 2002, concurs that attacks on upstream food producers have the most potential to cause harm and would be relatively easy to execute. The interconnectedness of the UK food chain with other critical components of the UK's infrastructure, in particular the electricity grid and the road network, represents an additional concern.[87]

However, Omand also maintains that although the food chain is vulnerable to attack, it would be difficult to bring about a disruption capable of causing lasting and widespread damage.[88] The

CPNI likewise maintains that the size and diversity of the UK food industry, whilst making it more vulnerable to attack, also makes it more resilient to lasting damage. The overall availability of food supplies and the ability to substitute one food for another will always make it extremely difficult for malicious attacks to cut off the food supply sufficient to cause serious disruption.[89]

To date, the UK has been fortunate that this assessment has been borne out by events. For instance, a notable incident recorded by the CPNI involved a major producer of pastry goods losing five days of production in 2007, at a cost of 5 per cent of its annual turnover, when its factory was shut down following a malicious attack that introduced peanuts onto the site, which was designated as nut-free.[90] Bad as the situation was for that food producer, however, the incident did not have a significant impact on food security nationwide.

This is not to underplay the threats that do face the UK food chain. The UK food chain has suffered a number of severe non-malicious shocks in recent years. Resilience experts such as Omand and Sir Brian Bender, Permanent Secretary at the Ministry of Agriculture (subsequently DEFRA) between 2000 and 2005, maintain that it would be possible to induce similar shocks maliciously. The physical openness of most farmyards, the concentrated and intensive nature of contemporary farming practices, and the fact that vetting procedures for farm workers - many of whom come from abroad on a temporary basis – are almost non-existent, all contribute to the UK's vulnerability to the introduction of disease to livestock.

The fact that the most recent major shocks to afflict the food chain in recent years have been non-malicious does not reduce the need for vigilance by policymakers. It is notable that the conclusion reached by the government in the wake of the Foot & Mouth crisis in 2001 was that were al-Qaeda to attempt an agroterrorist attack, then the Foot & Mouth crisis would serve as an example that would be difficult to surpass in terms of damage caused.[91]

In the past two decades the UK has had to deal with a number of major shocks which have, in their different ways, all impacted upon the UK food chain. These have included the BSE crisis (1986-mid-1990s); the Fuel Protests (2000); the Foot & Mouth outbreak (2001); the H1N1 Influenza (2009-2010); the eruption of the Icelandic volcano Eyjafallajökull and the resulting ash cloud which shut down air traffic across Europe (2010); and most recently the E-Coli outbreak (2011). Between them, these crises cost the British economy in excess of £15 billion and, in the case of the BSE and H1N1 crises, 629 human lives.[v] The most severe of these crises in economic terms, the Foot & Mouth crisis of 2001, cost the British economy in excess of £8 billion[92] and resulted in the slaughter of some 4 million animals.[93]

Perhaps the clearest example of how quickly a localised disruption can escalate into a major national crisis, however, is the Fuel Protests of 2000. What began as scattered picketing of oil refineries by farmers and hauliers on 8th September rapidly developed into a nationwide series of blockades. By 13th September, just five days later, almost

v. The BSE outbreak claimed 173 lives in the United Kingdom and the H1N1 outbreak claimed 457. Although both Foot & Mouth disease and E-Coli have claimed lives elsewhere in the world, neither of these crises claimed lives inside the United Kingdom during the incidences mentioned. Although both the fuel protests and the Eyjafallajökull eruption may have cost lives indirectly, they have not been directly attributed to loss of life in the UK.

three-quarters of petrol stations had run dry,[94] with supermarkets warning of limited stocks owing to their inability to resupply their stores. Here too, panic-buying broke out.[95] Coming to terms with the scale of the situation, then-Prime Minister Tony Blair responded by putting the NHS on an emergency footing and the army on standby, deploying some eighty military fuel tankers around the country and invoking emergency powers to ensure delivery of fuel to vital services.[96] The fuel protests demonstrated the dangerous limitations of operating vital services on a 'just-in-time' basis.

Equally significant is the fact that, with the exception of the H1N1 influenza, neither the fuel protest nor any of the other crises mentioned was foreseen by the government. As the CPNI and others have recognised, therefore, effective and flexible response mechanisms are as, if not more, important to dealing with these shocks effectively than efforts to prevent them in the first place.

In its most recent assessment of UK food production resilience, the government concluded that the UK remains well-placed to withstand disruptions to food imports. Although the UK currently relies on imports for around 48 per cent of the food it consumes, the majority of imports come from within the EU, which as a whole is over 90 per cent self-sufficient.[97] Not only does the government consider a breakdown in trading relationships between the UK and/or the EU and the rest of the world unlikely, it points out that potential cultivatable land comfortably exceeds presently harvested land, and that production could be increased in response to strong market signals.[98] The report points out that even during the Second World War, the UK was never entirely self-sufficient, but that even in a worst case scenario in which the UK is entirely isolated, it would nonetheless retain sufficient productive potential to feed its population adequately, albeit on a significantly altered diet.[99]

That the UK could, *in extremis*, prevent its population from starving to death will be a comfort to policymakers on one level. On another level, however, this is hardly the gold standard. Disruptions to UK food supplies can fall a long way short of total collapse before they generate very serious problems. Nor need disruptions be long term to do real harm. As the MI5 maxim puts it, at any one time the UK is "four meals away from anarchy". Whether or not this is taken as an overstatement, it nonetheless makes the point. For this and many of the other reasons already outlined in this report, policymakers should be actively pursuing policies that not only minimise the potential for disruptions to the food-chain, but also guarantee the British population a continued supply of accessible, affordable, and nutritious food.

Critical Areas for Further Consideration

As this report has sought to highlight, global food security is about much more than ensuring the world's population has enough to eat. Rising food prices are impacting adversely on economic growth in both the developed and developing worlds, and they are also contributing to conflict and even revolutions that in the past 12 months have, in the case of Libya, resulted in a British military response. As the world's largest producer, importer and exporter of food, Europe has a particular responsibility to help meet the world's growing food needs, and its agricultural policies can and do impact on that effort both within and beyond its borders. Moreover, although not vulnerable in the same way as many developing countries, the UK food chain is not immune to shocks and disruptions, whether accidental, natural or malicious, and this should be an active concern for policymakers. This section of the report highlights a number of key areas on which both policymakers and industry experts will need to focus, not only to ensure that the world has enough food to eat in coming decades, but also to ameliorate these other related concerns in the process.

BIOFUEL TARGETS

Numerous reports from the United Nations, the UK government and other sources have demonstrated that the drive to increase the use of biofuels has contributed significantly to rising global food prices, and will continue to do so in future. The pursuit of biofuel targets could inflate the price of food by anywhere between 15-40 per cent over the next decade, even excluding other variables that could push the price up still further.

When biofuels began gaining widespread popularity in the late 1990s/early 2000s, global food prices were comparatively low, at around 90-120 on the FAO's FPI.[100] With food prices rising rapidly, in part as a consequence of biofuels, the mandatory biofuel production targets imposed by the EU and others demand recalibration.

The European Council has stated that its mandatory 10 per cent minimum target for the share of biofuels in transport petrol and diesel consumption by 2020 *"...is appropriate, subject to production being sustainable, second-generation biofuels becoming commercially available and Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels [7] being amended to allow for adequate levels of blending."*[101] Enhancing the commercial viability of second-generation biofuels, which are derived from woody crops, agricultural residues and waste is crucial. If biofuels are to become a lasting part of the energy-mix, they must be derived from non-food sources to the greatest possible extent.

If biofuel targets are not to be scrapped altogether, they should at least be more flexible, with one possibility being to specify a relationship between the FPI and the diversion of biofuel feedstocks back into the food-chain. The decision as to what figure would mark the threshold beyond which such a diversion could take place should be based on an assessment, such as the one carried out last year by the New England Complex Systems Institute, of the tipping-point beyond which food-related insecurity could become significantly more likely.

EU REGULATION OF CROP PROTECTION PRODUCTS

Crop protection products are vital to protecting crops from pests and disease, and to help farmers produce food at an affordable price. Plant pests and diseases currently account for approximately 40 per cent loss in global production, and recent scientific forecasts predict that this problem will get worse.[102] The stated direction of EU policy, as laid down in the Sixth Environment Action Programme (6th EAP), is *to "encourage low-input or pesticide-free cultivation"*.[103] Many farmers believe that unofficial policy is to work towards eliminating the use of pesticides inside the EU altogether.

This hostility to crop protection tools is misguided, and needs to be addressed.

Not only are EU pesticides regulations hurting farmers, they also have a detrimental impact on food security inside the EU. The UK government's Chemicals Regulation Directorate has estimated that the EU's latest pesticide directive could have the adverse consequence of cutting crop yields by as much as 20 per cent.[104] Clearly, this is something that both the UK and the EU as a whole cannot afford. The FAO has predicted that if current trends continue, a combination of slowing yields, rapidly increasing demand and rising energy prices will push the average price of food up by 20 per cent. On their analysis, even a 5 per cent reduction in wheat yields would result in a 25 per cent increase in price. Should the same thing happen to the global rice crop, the price would rise by almost 25 per cent, likewise with coarse grains, whilst the price of poultry meat would rise by around 12 per cent.[105]

In a recent UK-focused analysis, the Crop Protection Association concluded

that a failure to invest in effective crop protection products could lead to a 40 per cent increase in the nation's food bill, costing an extra £70 billion. Such a price increase would result in a *"loss of choice and a decline in the nation's health and nutrition as households reduced consumption of expensive fruit and vegetables."*[106]

Ecological concerns certainly constitute a legitimate reason to regulate the use of crop protection products. However, it is equally important for EU policymakers to understand the interconnectedness of regulation in this area with a host of other concerns, and to consult more closely with farmers regarding the ramifications of policies that too often hinder sustainable farming. Given that farmers are responsible for some 44 per cent of all the land within the EU, they remain amongst the best-placed custodians of our environment.[107]

Today, Europe is losing products that have been scientifically proven as safe because regulation is driven by the perception of hazard, rather than science-based evidence of risk. The EU must revisit its regulation of crop protection products to ensure that regulations in this area are science-based and proportionate.

EU REGULATION OF GENETICALLY MODIFIED ORGANISMS

The decision to introduce a genetically modified organism into the natural environment, particularly for products destined for human consumption, must be taken with the greatest care. However, over the past decade, a number of investigations into the potential dangers of GMOs have found no evidence that GM food is harmful. As mentioned in Section One of this report, recent reports from both the Royal Society of Medicine and the European

Commission Directorate-General for Research have concluded that there is no evidence that GMOs pose a risk to human health any more than traditional plant-breeding technologies.

Unfortunately, the EU's approach to GMO regulation is driven as much by politics and perception as by empirical scientific evidence. At present, the EU's GM authorisation framework has two distinct and separate phases. The first is the risk-assessment phase, involving a scientific assessment of human and environmental risks by independent scientists operating under the auspices of the European Food Safety Authority (EFSA), in collaboration with experts from member states. The EFSA then provides a scientific opinion to the European Commission on the product.[108]

The second phase, by contrast, is a politically-led process. Member states take into account the EFSA's scientific opinion in tandem with 'other legitimate factors', before making a final decision about whether to authorise a GM product.[109] This can result in a heavily politicised process, in which science-based considerations over whether or not the product in question may be harmful to humans or the environment often become a secondary determining factor.[110]

Under current proposals to reform the approvals process for cultivation of crops inside the EU, an amendment has been put forward that would allow individual governments to ban the cultivation of approved GM crops on social or economic grounds, such as public opposition or to safeguard organic farming.[111] This is a step backwards. Instead, the EU should be focusing on reforming its GMO approvals process so that decisions are made solely on the basis of scientific evidence of risk and benefits.

Additionally, the EU should work to streamline the approvals process, which is prohibitively complex and expensive. The average time required to approve a GM product for import into the EU is 45 months.[112] That compares with 30 months in Canada, 27 months in Brazil, and 25 months in the United States. The situation is worse still when it comes to authorising GM products for cultivation inside the EU: in the past 13 years, just two products have been authorised for cultivation.[113] As of August 2011 there was a backlog of 72 GM products in the EU approvals system, 51 for import or processing, and 21 for cultivation.[114] Ironically, the complexity of the current system benefits large GM companies such as Monsanto, which currently dominate the market in GMOs; smaller companies find it extremely difficult to compete in such a complex and costly system.[115]

The UK government's official stance on GMO approvals is that it should be a science not politics-led process, and maintains that the growth and sale of GM food or feed products should be granted only after "a robust risk assessment indicates that it is safe for people and the environment".[116] The government should work with like-minded EU member states to reform the approvals process and achieve this goal.

GMOs are by no means the sole solution to current challenges to global food security, but as the government's 'Foresight' report and many other studies have concluded, they have an important role to play.[117] As the Royal Society has noted in a recent report, past debates on the use of new technologies in agriculture have to often presented policymakers with a false dichotomy; an either/or approach, emphasising the value of one approach over the downsides of others. In reality, no single technology or approach can be viewed as a panacea, but nor should promising technologies be ignored for the sake of political expediency.[118]

EU AGRICULTURAL TARIFFS & EXPORT REFUNDS

Agricultural protectionism has long contributed to high global food prices and food insecurity. As the government's 'Foresight' report has argued:

"*Production subsidies, trade restrictions and other market interventions used by high-income countries have become of huge significance because of the financial and political powers of the nations involved. This political significance has allowed subsidies and barriers to trade in agricultural markets to assume levels far in excess of those applied in any industrial sector."*[119] Agricultural tariffs in the EU are on average three times higher than the average across industrial goods, and certain key commodities are protected by tariffs of more than 70 per cent.[120]

Unfortunately, the Doha Development Round at the World Trade Organisation (WTO), where international efforts to reduce agricultural tariffs are conducted at a multilateral level, has been stalled since 2008. The EU remains engaged in a series of bilateral talks with other countries focusing on these issues, yet it is difficult to see how any balanced and equitable reduction of agricultural tariffs can take place a without recourse to a global forum such as the Doha Rounds at the WTO.

In addition to tariffs, another related area of concern is export refunds. In late January 2009, *"...in response to the serious situation on the EU dairy market",* the EU announced its decision to increase subsidies for dairy products, with export refunds of as much as €200 per tonne offered for skimmed milk, and €580 per tonne for butteroil. It was decided that the measure should apply *"...for as long as market conditions so dictate".*[121]

The decision met with a critical response from the Cairns Group, a coalition of 19 agricultural exporting countries committed to reforming agricultural trade:[122]

"This is a dangerous action, given the risk that it could encourage further trade-distorting responses which need to be avoided. Moreover, by resorting to export subsidies again, as it did last year for pork and did previously for wheat, the EU continues to shield its producers from market forces, at the expense of unsubsidised producers in other markets. It is of particular concern that farmers in many developing countries, which cannot afford to engage in subsidy wars, stand to suffer most from increased distortions in world agricultural markets. This is not the leadership we require from key economies at this point in time."[123]

Export refunds have declined significantly in recent years, and now constitute just 0.5 per cent of the Common Agricultural Policy (CAP) budget. The EU has offered to phase export refunds out altogether, but this is on the condition that other countries drop similar trade-distorting subsidies.[124]

Major food producing countries and regions must recognise that protectionist policies designed to benefit consumers at home often impact those living beyond their borders. When Russia, the world's third largest wheat exporter, imposed a grain export ban at the start of August 2010 in response to drought and wildfires, the result was a surge in global wheat prices.

This in turn drove global food prices up by 5 per cent in the biggest month-on-month increase since November 2009.[125] When Russia announced its decision to lift the embargo at the end of May 2011, markets responded by almost immediately dropping the price of wheat by 5 per cent.[126]

Given that the EU remains one of the world's biggest producers, exporters and importers of food, the impact on global food markets were it to take similar action for whatever reason would likely be as if not more severe. Indeed, it is not even clear that EU food protectionism benefits European consumers. In 2008, it was estimated that the EU's agricultural policies increased food prices by as much as 12 per cent.[127] Europe's importance in the global food markets has meant that protectionist policies have generated significant food security problems. The government must continue its efforts to convince its European partners of the folly of some of these policies.

THE COMMON AGRICULTURAL POLICY (CAP)

Many critics of EU agricultural policy believe that the Common Agricultural Policy (CAP) is a particularly blatant example of protectionism that should be dispensed with entirely.[128] This report argues that the CAP should not be scrapped, but that the ongoing reform process must be reorientated towards maximising productivity and eliminating the subsidisation of waste.

The EU's Agriculture Commissioner, Dacian Cioloş, has recently argued that the market cannot be relied upon completely for something as strategically important, and vulnerable to external events, as food production.[129] For a country to retain the capacity to feed its population in times of need as well as times of plenty is a strategic *sine qua non.* A country can become dependent on the markets for the import of most things, and survive if those lifelines are cut off, but no country can survive without food. As the Arab uprisings this year have demonstrated, food scarcity can trigger violence and revolution long before supplies are cut off completely. UK food self-sufficiency has declined rapidly in the past two and-a-half decades, from almost 80 per cent in 1984 to 60 per cent now. A reason for this has been that the high costs UK farmers incur producing British food make it difficult to compete against farmers in other markets where the cost of production is lower.

It is important to note the achievements of CAP as well as its deficiencies. For instance, by decoupling payments from production, the CAP has helped reduce market distortions resulting from payments, and has brought European policy in line with WTO rules.[130] However, as the WTO has repeatedly stressed, further reforms are needed to reduce market distortions arising from the CAP. This being said, such reforms must be conducted in a way that enables European farmers to maximise food production and remain in business.

Many of the most egregious CAP subsidies have been significantly reduced, if not eliminated, in recent years. In 2008, the EU suspended the set-aside policy, first introduced in 1988, whereby farmers were actually paid not to produce food on a given percentage of their agricultural land.[131] Concluded during the 2007-08 price spike, the decision was a welcome recognition of the fact that for Europe, as for the rest of the world, the era of 'butter mountains' and 'wine lakes' is over. As mentioned in the previous section, the export refund system has also been improved, and has now been reduced to less than 0.5 per cent of the total CAP budget.

The EU is currently in the midst of a major effort to reform the CAP process by 2013, the last such round of reforms having taken place in 2003. On 12th October 2011, the European Commission produced its latest proposal for CAP reform, to mixed reviews. Certain measures contained within the proposal are to be welcomed, for instance doubling the budget for agricultural research and innovation, and seeking to facilitate the establishment of young farmers, in light of the fact that two thirds of European farmers are 55 years of age or older.[132] It should be said, however, that market forces will always provide the surest incentive for young people to enter any profession. If, after two decades of decline, farming once again becomes a profitable and valued profession in Europe, then the problem of finding young people to become farmers will take care of itself.

However, some of the other measures proposed are less welcome. The EU has placed disproportionate emphasis on environmental 'greening' policies as part of the CAP. Under the plans, 30 per cent of direct support to farmers through the CAP will be conditional on following mandatory actions deemed beneficial to the environment. Likewise, in an unwelcome return to *de facto* set-aside policies, farmers will also be obliged to set aside 7 per cent of their land for ecological purposes.[133]

Supported by the National Farmers' Union (NFU), the government has rightly criticised the plan, remarking that *"taking 7 per cent of land out of production when demand is increasing would not be sensible"*.[134]

The UK government should work with its European partners to oppose the inclusion of 'greening' policies in the CAP should such policies come at the expense of maximising food production.

If environmental considerations are to form part of the new CAP, then they should be less uniform than they are at present. There are approximately 300,000 farms in the UK, occupying a diverse range of arable and pastoral land.[135] Inevitably, some farms occupy land that is better for farming than others, and the EU should consider ways by which the most fertile farms could set aside less of their land for environmental purposes, whilst farms with land more suited to such diversification, could set aside more.

The EU is right to maintain environmental regulations, but the CAP should not be one of them. Its purpose must be to enable farmers to maximise food production, and the government must keep this at the forefront of their efforts in the new round of CAP reforms.

UK AGRICULTURAL RESEARCH & DEVELOPMENT (R&D)

By 2050, the world will need to produce

70 per cent more food than it does presently in order to feed 2 billion additional people and meet greater increases in nutritional demands. Moreover, this food will also have to be produced using proportionally less water, on about the same amount of land, and without causing additional harm to the environment.

When the Green Revolution transformed global agriculture 50 years ago, it did so through innovation and technology, not through the cultivation of significant quantities of new land.[136] Ultimately it was scientific developments which enabled the world's farmers to defy Malthus's famous predictions. Given the additional constraints imposed upon the farmers who will supply the global food supply for the next 50 years, innovation will become even more important. The UK government must therefore invest in UK agricultural research and development (R&D). As a starting point, the government should support EU proposals to double the agricultural research and innovation budget as part of ongoing CAP reforms.[137]

One of the clearest examples of the critical importance of R&D is in addressing the coming water supply crisis. In 2009, it was estimated that humans consumed 54 per cent of the world's freshwater supply, 70 per cent of which went on agriculture. If per capita consumption rises across the globe at the rate seen within developed countries, this could increase to 90 per cent by 2025.[138] This problem is compounded by the fact that farmers face increasing competition for dwindling water supplies from the world's many rapidly growing cities.[139] Farmers are going to need to produce more food with comparatively less water, and in this endeavour science will have a vital role to play.

As the Royal Society has noted, water stress is particularly acute in hot, dry regions of the world, where much larger amounts of water are needed to produce the same grain yield than in less stressed regions.[140] A high priority for the future, therefore, will be to develop

crops that maintain or even increase yields but require reduced amounts of water. Such developments will be even more urgent if the predicted impacts of climate change come to pass. To this end, irrigation will require significantly improved applied research. Irrigation is an essential tool for increasing crop yields, as demonstrated by the fact that although irrigated areas account for just 20 per cent of the world's total cultivated area, they produce almost 50 per cent of its food.[141]

There are also compelling financial motivations for undertaking agricultural R&D. According to the Royal Agricultural Society of England, estimated returns on investment in publicly-funded agricultural R&D range from 10 per cent to over 50 per cent. A recent UK estimate shows a marginal rate of return on R&D of about 17 per cent after taking into account 'spill-overs' from private and international R&D.[142] The vast gains in agricultural output that took place as a consequence of such investment led directly to the dramatic drop in global food prices over a period of several decades, from the mid-1970s to the mid-2000s.

Between 1953 and 1984, the productivity growth of UK agriculture – Total Factor Productivity (TFP) – was 1.68 per cent per annum. However, between 1984 and 2000, growth slowed to just 0.68 per cent, with the UK falling behind leading EU countries. Although a number of factors contributed to this relative decline, cuts to agricultural R&D investment have been identified as a primary driver.[143] An apparent reduction in the status of applied research as against basic science research, combined with a reduction in the number of scholarships available for PhD training in applied agricultural research, has perhaps also resulted in a reduction in the number of scientists involved in research directly linked to the industry and those who remain are getting older.[144]

This is precisely the wrong direction for the UK to be travelling in. Retaining its status as a world-leader in innovative research should be a priority for the UK, given the relative decline of a number of other sectors of its economy. Over the past few decades, notable UK-led agricultural innovations have included the introduction of semi-dwarfing genes into wheat stocks, responsible for a 14 per cent increase in yields; intelligent breeding techniques that have led to fundamental improvements in cereal resistance to pest drought and adverse temperatures worldwide;[145] and the development of a new variety of broccoli that is suspected to lower the risk of heart disease and some forms of cancer.[146] The value of these and similar advances has been immense, and represents exactly the kind of developments that the world will need to feed itself sustainably by 2050. Since many developing countries still lack the requisite R&D capabilities to meet their food security challenges unassisted, leadership from countries such as the UK will become all the more important.

Finally, the UK government should not neglect the importance of R&D in preventing agriculture-related diseases which can have an enormous economic impact. Animal and crop diseases cost the British economy some £1.24 billion per annum, and developments to reduce these losses must be treated as a priority area of research.[147]

THE RELATIONSHIP BETWEEN FOOD SECURITY, FOREIGN POLICY AND DEVELOPMENT POLICY

The world currently produces more than enough to feed the global population of 7 billion people adequately, with some estimates suggesting that sufficient food is already grown to feed 11.5 billion people.[148] The problem is that this food is not equally distributed—while some states have more than enough, others have much too little. Consequently, improving access must be as much a priority in achieving global food security as enhancing production. Some campaigners have gone so far as to argue that measures to improve food production are unnecessary, and that improving access, reducing waste and rectifying imbalances in the global food system can solve the problem. This argument is unrealistic. Distributional imbalances are not the only concern, either for those in the rich, developed world, or for the world's poorest countries. If output falls below demand, food prices will rise. Higher global food prices will put food still further out of reach for those who need it most, whilst price volatility wreaks havoc with small farmers who are left not knowing how or where to invest.[149] Likewise, changing habits is far easier said than done, and today the food system is obliged to balance growing food concerns with new environmental ones.

Consequently, policymakers need to find ways of improving access to food without adversely affecting the existing market, and must look at the wider causes of food insecurity, in particular poor governance and state failure. Almost every country in the world currently assessed to be suffering from high or extreme levels of food insecurity is also ranked as amongst the world's weakest states. The roll-call of names is all-too familiar: DR Congo; Somalia; Ethiopia; Sudan; Zimbabwe; North Korea; Yemen.[150] Environmental considerations such as extreme weather or lack of rainfall are only one component of the problem. It is telling, for instance, that Israel, a country with the same level of food security risk as Portugal or Spain, has just half the annual rainfall of Ethiopia.[151] It is certainly no coincidence that, to date, no functioning democracy has ever suffered from famine.[152]

The ongoing famine in the Horn of Africa has been described as a —'governance drought' that took place not because insufficient food was available in theory, but because the systems required to get it where it needs to be in time are inadequate. The drought was predicted by various early-warning systems including the Famine Early Warning Systems Network (FEWS NET) and the Arid Lands project as early as 2010, but very little was done to prepare.[153] In Kenya, food has rotted needlessly because the transport infrastructure needed to get it to market is inadequate.[154]

In the October 2010 Comprehensive Spending Review (CSR), the government committed to enshrine the size of the UK's overseas development budget in law, at 0.7 per cent of GDP, from 2013.[155]

However, numerous studies have shown that simply spending more money on aid is not the answer to these deep-rooted problems, nor are projects limited to providing immediate food aid, or even helping farmers to produce more food sustainably. Improving farm productivity achieves little if the transport infrastructure needed to get that food to market is not in place. Likewise, producing a sufficient food supply is irrelevant if failing economic policies result in inflated prices that prevent the population from being able to buy it.

Sensitivity to accusations of colonialism have made many European countries—and the UK in particular—overly cautious about efforts to coordinate altruistic development objectives with measures that robustly seek to improve the quality of governance in target countries. This cannot continue. Food insecurity, resource conflict and governance are intimately interlinked, and development policy must clearly reflect that fact.

FOOD WASTE

One of the most egregious contributors to food insecurity is the staggering amount of food that is wasted each year. It is estimated that in both rich countries and poor, some 30-50 per cent of all food produced rots away uneaten.[156] According to the FAO, post-harvest waste in Africa explains why many smallholders are net purchasers of food, even though they grow enough for their families to eat. For its part, it is estimated that UK households waste 25 per cent of all the food they buy.[157]

In both the developed and developing world, initiatives that successfully reduce food waste can contribute towards redressing global food insecurity. It has been estimated that eliminating the millions of tonnes of food wasted every year in the UK and US alone could lift a billion people out of hunger.[158]

In the developing world, most food is wasted before it reaches the consumer. Inadequate anti-pest safeguards on farms allow rats, mice or locusts to eat crops in the field or in storage. Poor road infrastructure and a lack of proper refrigeration result in goods spoiling in transit.[159] As food constitutes a far greater proportion of household income in poor countries – as much as 60-80 per cent in some cases – a comparatively small amount is wasted by consumers once they obtain it.[160] Consequently, dealing with food waste in the developing world is primarily a matter of improving the capacity of food producers to reduce waste before food reaches the market.

As in the developed world, this entails such measures as building proper silos, better roads and providing better refrigeration.

However, these solutions are expensive, and will require significant investment from committed sources, including multilateral donors such as the World Bank, the African Development Bank and the Asian Development Bank as well as individual government sources such as the UK's Department for International Development (DFID). The government should also be ready to advocate measures that broaden access to pest or drought-resistant crops amongst poor farmers, and to support research into the development of these products.

More could always be done towards these ends, but as is the case more broadly, development policies must combine these ground-level targeted measures with efforts to improve governance deficiencies that perpetuate such failures in the first place.

In the developed world, by contrast, those

most responsible for wasting food are consumers themselves. According to the EU, households produce approximately 42 per cent of the total amount of food waste, food manufacturers 39 per cent, retailers 5 per cent and the catering sector 14 per cent.[161]

Food waste by consumers is primarily a behavioural issue. In order to change attitudes, awareness campaigns can play an important role. For instance, distinguishing between food date labels (for example, the difference between "best before" and "use by"); advocating re-using food; food composting; and encouraging refrigerated food storage can improve both food safety and reduce food waste.

Ultimately, however, the government must recognise that the majority of consumers will not change their habits until there is sufficient financial incentive for them to do so. There are legitimate questions about whether the government should penalise its citizens for how they choose to use food that they have purchased, and whether such a course would even be possible. It is certainly not the position of this report to advocate such measures. Unfortunately, the reality remains that the impact of purely voluntary campaigns and awareness-raising will only ever be limited.

Retailer food waste can be curtailed using food banks, which collect food surpluses from retailers, wholesalers, bakeries, auctions and individuals through national and local collections and redistribute the supplies it to those in need.[162]

Another area requiring further attention and research is EU legislation governing the feeding of food waste to livestock. Since 2001, feeding catering and domestic food waste to livestock has been prohibited. Whilst retail and manufacturing non-meat foodstuffs can be fed to livestock, this does not apply if that food has been handled under the same roof as meat, unless the operator can demonstrate that it cannot come into contact with meat.[163]

Objections to the relaxation of legislation in this area relate to the fact that the outbreaks of both Foot & Mouth disease (2001) and classical swine fever (2000) in the UK were traced back to badly-managed swill-feeding systems.[164] The

concern is that contaminated food waste would represent a likely entry-point for such diseases into the UK food-chain if regulations were relaxed. However, it has been argued that such contamination risks could be overcome by sterilising food waste before feeding it to livestock. Heating has been demonstrated to be a guaranteed way of killing pathogens such as Foot & Mouth disease and classical swine fever.[165] Although food waste derived from meat should not be fed to herbivores such as cows and sheep, such restrictions need not apply to omnivorous animals such as pigs and chickens.

From an economic perspective, the conversion of food waste into livestock feed makes sense. According to the campaigning group Food AWARE, some 18 million tonnes of edible food ends up in landfill every year, with an annual value of £23 billion.[166] Although the government now favours Anaerobic Digestion (AD) as a more environmentally-friendly method of food waste disposal than landfill, this method has its limitations.[167] As mentioned, bakery products and unwanted fruit and vegetables can be fed to livestock so long as they have not come into contact with meat. Whereas waste producers pay in the region of £80 per tonne to dispose of food waste through AD, if the food waste can be separated from animal products it can be sold to farmers for roughly £20 per tonne.[168]

The conversion of food waste into livestock feed could also have environmental benefits. It has been estimated that between two and 500 times more CO^2 could be saved by feeding food waste to pigs rather than sending it for AD.[169] As industry expert Tristram Stuart has observed, the EU imports some 40 million tonnes of soy for pig feed every year, the production of which comes at a significant environmental cost.[170] Not only that, but soy imports are increasingly expensive, the price of soy having increased by almost 200 per cent in 10 years—costs which could be abated by replacement with food waste.[171]

EMERGENCY FOOD RESERVES

The long-term problems of food price rises and price volatility can only be solved by measures which sustainably enhance productivity and improve access, especially in the developing world. However, as a short-term buffer against the impact of price spikes on the world's poorest consumers, emergency food reserves could have an important role to play.

Many countries have the capacity to redistribute food from places of plenty to places of shortage in times of need. In a number of countries where governance or infrastructure is poor, this is not the case, and countries that are net-food importers may also struggle to find surplus capacity when necessary.[172]

Although some countries such as the Philippines do still hold emergency food reserves, the trend in recent decades has been towards a greater reliance on imports from global markets to meet a given country's food needs. In 2010-11, the FAO estimated that global cereal stocks declined dramatically from 534 million tonnes to 490 million tonnes, although stocks are expected to remain relatively constant in 2011-12, at 493 million tonnes.[173] As a developed country whose own food security is assessed to be high,[174] the UK does not currently have any reserve food stocks of its own.[175] According to the government, the decision to discontinue the maintenance of intervention stores of food was taken during the early 1990s owing to the reduced threat at the end of the Cold War, and the considerable cost (£10 million per annum at 1990 prices) of their retention.[176] The stocks that do exist are within the commercial food chain, and have been in decline in recent years.[177]

One of the primary objections to nation states maintaining food reserves is that this distorts markets, depends upon good governance, and is costly to maintain.[178] Most food is perishable, and must therefore be physically stored in adequate facilities, and regularly rotated. It has been estimated that the cost of holding grain stocks is as high as 15-20 per cent of the value of the stock per year.[179] Some have argued that it is cheaper and more efficient to hold earmarked cash reserves to purchase supplies from international markets as required. However, as the 2007/08 price spike demonstrated, sudden and extreme price rises can nullify the efficacy of this approach.

Under such circumstances, the utility of international, if not national, food reserves becomes more apparent. However, at present, very little in the way of international food reserves exists. The World Food Programme (WFP) does possess grain reserves in boats around the world, and the WFP estimates that it manages to feed more than 90 million people every year.[180]

Although the WFP has saved many lives in response to emergencies, it is stymied by the fact that it is institutionally reactive, not proactive. In the view of Dr David Nabarro, the UN Secretary General's Special Representative on Food Security and Nutrition, WFP funding is critically flawed.[181] Funding is allocated on a year-by-year basis, and is derived primarily from humanitarian money (reactive) rather than development money (proactive). The WFP was only recently permitted to engage in futures trading and advanced purchases, critical elements in developing a more forward-looking and effective approach.[182] Further reform to enable the WFP to operate in a more proactive and businesslike way is needed, and the government should prioritise these developments. Far too many people are dying from starvation because action is not taken until after

a crisis has developed, as has been the case with the ongoing famine in the Horn of Africa. Serious consideration should also be given to building emergency food reserves held by the WFP to further enhance its capacity to respond to and prevent food-related crises.

One potentially positive initiative currently being trialled is a food reserve system designed to meet the needs of food-importing developing countries with limited capacity. The proposal, put to G20 agriculture ministers at their inaugural meeting on 24th -25th May 2011, involves maintaining food reserves that can be accessed by eligible states at affordable prices. Dr Nabarro maintains that this is not a price-control mechanism; rather food would be made available at the lower end of the price index in the event of sudden price rises or fluctuations. The initiative was agreed to at a meeting of G20 development and finance ministers in late September 2011, and will be tested initially in West Africa, in coordination with the regional body, the Economic Community of West African States (ECOWAS).[183] Should this initiative prove successful, there will be a strong case for rolling it out in other parts of the world with high levels of food insecurity.

UK FOOD-CHAIN RESILIENCE

UK food security is currently assessed as high by both the UK government and non-governmental organisations that assess food security at the international level.[184] However, the UK food chain remains vulnerable to shocks, whether accidental, natural or malicious, and it is imperative that policymakers undertake measures that minimise the vulnerability of the UK food chain.

Sir David Omand has identified three levels of resilience. First, the identification level: identifying potential problems and developing contingency plans to help prevent them. Second, policymakers must always recognise that because not every shock is preventable, investment in community resilience is necessary in case specific targets are taken down. Third, it is vital to invest in "adaptive resilience", drawing upon past experience when deciding future policy and making decisions that

involve replacing or upgrading physical infrastructure and logistics networks.[185]

The CPNI has produced an extensive list of measures that the UK food industry should take to minimise the threat of disruption to their services. This includes training managers to assess the kind of threats to which their sites or services may be vulnerable; employing appropriate vetting procedures; controlling physical access to premises; controlling accesses to services, materials and processes; and ensuring the secure storage of transport vehicles.[186]

This document, entitled PAS 96, is only advisory and is non-binding. This is consistent with the government's current relationship with the food industry on resilience issues, which is non-regulatory and relies upon the voluntary implementation of best practice. Whether or not this remains the case, the CPNI must continue to work with the food industry, particularly in assessing emerging threats such as cyber-damage, to assess which areas demand closer attention.

The most recent assessment of business competence on resilience was carried out in 2006 by Dr Helen Peck, in Defra-sponsored report, *Resilience in the Food Chain: A Study of Business Continuity Management in the Food and Drink Industry*. This report, which is referenced in the UK government's more recent food security assessment, concluded that few British companies engage in proactive or preventative BCM.[187] As is the case across the UK food chain, those companies included in the report prefer to operate on a 'just-in-time' as opposed to 'just-in-case' basis, due to resource constraints, lack of expertise and pressures to maximise profits.[188] Moreover, there is still comparatively limited awareness of the importance of BCM or food security at the company level, although this is a growing concern.[189] The primary concern for these companies in the event of a crisis is brand reputation.[190]

As both the CPNI and individuals such as Sir David Omand have recognised, proactive or preventative resilience is only one part of the solution. Given the size and complexity of the UK food chain, it is virtually impossible to prevent every attack or crisis. Consequently, reactive resilience must also be a primary concern. The government should recognise that all crises are fundamentally local. The government must therefore assess how local communities would cope if confronted with a significant disruption to the food chain, and work with them to develop mechanisms capable of mitigating such shocks and disruptions.

Food companies are comparatively more engaged in reactive resilience. All of the organisations surveyed in Dr Peck's study had some form of IT-related continuity planning/disaster recovery in place.[191] However, even when it comes to reactive BCM, most companies do not view this as a necessity. Those companies that do engage in BCM do so primarily at the behest of clients, or for reasons of compliance. Certainly, when companies engage in BCM, it is for reasons of enlightened commercial self-interest; considerations of the 'public good' or the maintenance of operations in times of national emergency do not seem to play a part.[192]

The government should enhance efforts to raise awareness of the importance of BCM amongst the agricultural industry, in particular through the Food Chain Emergency Liaison Group (FCELG).[193] The FCELG is a Defra-chaired body which meets quarterly to discuss issues of concern to the food industry in terms of natural hazards and malicious threat. The group includes representatives from the food sector industries, as well as

relevant government organisations.

In order to ascertain the extent to which the food industry is taking resilience seriously, and voluntarily implementing the government's recommendations, the government should consider commissioning an updated version of Dr Peck's 2006 report.

The reality, however, is that individual businesses – especially small ones – cannot be expected to keep the national interest at the centre of their considerations with regards to the resilience of their operations. Compliance will always constitute the most significant driver of change in this area, and the government should perhaps consider ways to increase their resilience through mandatory compliance without damaging bottom lines unreasonably. Clearly, significant practical and financial constraints will always impede efforts to maximise food chain resilience and must strike a balance between enhancing resilience and ensuring that the UK food industry remains competitive.

Adaptive resilience, which is necessarily a long-term process, must also have an important role to play in these efforts, yet questions remain as to who will pay the cost. Ultimately, the consumer will pay for measures taken by companies to increase their resilience, but the government should also assess whether the UK's food security warrants subsidising resilience-upgrades by the food industry. Either way, the CPNI should work with the food industry and make the case for the business benefits of investing in greater resilience in the long-term.

Conclusion

The purpose of this report has been to highlight the interconnectedness of food security and other areas of concern for the UK government.

At a time of extreme economic fragility, the potential impact of rising food prices on the British economy represents a very real cause for concern. Rising food prices in the UK will only reduce the amount consumers spend on other sectors of the economy and further threaten an already halting economic recovery. Internationally, rising food prices in major emerging markets such as China and India constitute one of the principal drivers of high inflation, which is already slowing economic growth in those countries. Given that these countries are amongst the most important drivers of global economic growth, factors which damage that growth should concern Western economies, including the UK.

Whilst some of the drivers of rising prices are beyond the control of UK policymakers – for instance, natural disasters or the pace of agricultural reform in economies such as China – other factors can be influenced by UK policy, particularly at the European level. As a major global food producer and a leading player in the formulation of global agricultural policy in areas such as biofuels and GM foods, the EU has a crucial role to play in ensuring that the right policies are pursued not only to guarantee that all those living within its borders have adequate access to nutritious and affordable food, but also to contribute to global food security.

In addition to jeopardising economic growth, rising prices and food insecurity can contribute to conflict in regions such as Africa and the Middle East. For a globalised trading nation such as the UK, conflicts overseas jeopardise British interests and can necessitate a British response. Disruptions to trade flows, the generation of refugees and the international costs of post-conflict reconstruction offer compelling reasons why UK policymakers should proactively pursue measures that minimise food insecurity. As the conflict in Libya has shown, food insecurity – even if indirectly – can contribute to situations that require a British military response. It is likely that rapidly rising food prices in the MENA region acted as one of the catalysts which sparked the uprisings in Tunisia and beyond.

The fact that the UK is unlikely to suffer from large-scale popular unrest related to food prices or scarcity does not mean the UK food chain is not vulnerable to shocks and disruptions. The UK food-chain has suffered from a number of serious non-malicious shocks in the past two decades which cost the British economy some £15 billion and led to the loss of 630 lives. As bodies such as the CPNI and other industry experts have warned, agro-terrorist attacks, particularly if introduced upstream in the food chain, could cause serious damage.

These reasons present a persuasive case for policymakers to prioritise food security in the coming years. The government must recognise that environmental measures that directly undermine agricultural productivity and take needed food off the market must be reformed. The drive for biofuels

represents one such policy that should be reconsidered, and the introduction of environmental quotas into the Common Agricultural Policy should be resisted. The government must also address the problems caused by knee-jerk resistance to yield-enhancing technologies, including crop protection products and GMOs. As various bodies from the United Nations to the Royal Society have argued, these technologies are not the panacea to global food security problems, but they represent an important part of the solution. The government must also invest in agricultural research and innovation. In the next 40 years, the world will not only need to produce 70 per cent more food than it does now, it will need to do so on roughly the same amount of land, using comparatively less water, and with less harm to the environment. Achieving this task will be impossible without considerable agricultural innovation.

Increasing food production alone is not the entire answer. Every year, hundreds of millions of tonnes of food is wasted across both the developed and developing world, and measures to reduce this waste must be introduced. In order to ameliorate the immediate effects of price spikes or other food-related crises, the government should seriously consider efforts to enhance emergency international food reserves and reform the World Food Programme. The G20 pilot programme currently being initiated in West Africa may constitute an important model to follow. In the long-term, perhaps the most important step British policymakers can take to address the aforementioned problems is to promote improved governance, especially in the developing world. Poor governance impedes the economic progress, infrastructure development and productive investment vital to dealing with the agricultural deficiencies that continue to blight so many countries. As this report has sought to demonstrate, this is a concern the government should take seriously, not only for the sake of the world's most vulnerable people, but also to protect British interests.

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The Crop Protection Association (CPA) represents members active in the manufacture, formulation and distribution of pesticide products in the agriculture, horticulture, amenity, and garden sectors. At a time of rising food prices, population growth and concerns over global food security, farmers need to use every available technology – including pesticides – to meet future food needs and tackle the emerging challenges of climate change and resource conservation. The Crop Protection Association is committed to explaining the role of the crop protection industry in modern agriculture and the benefits of its products to the community. This includes engaging in constructive and intensive dialogue with relevant stakeholders to ensure that these benefits are fully recognised and accepted.

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Henry M. ‘Scoop’ Jackson
(May 31, 1912 – September 1, 1983)
U.S. Congressman and Senator for Washington State from 1941 – 1983

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