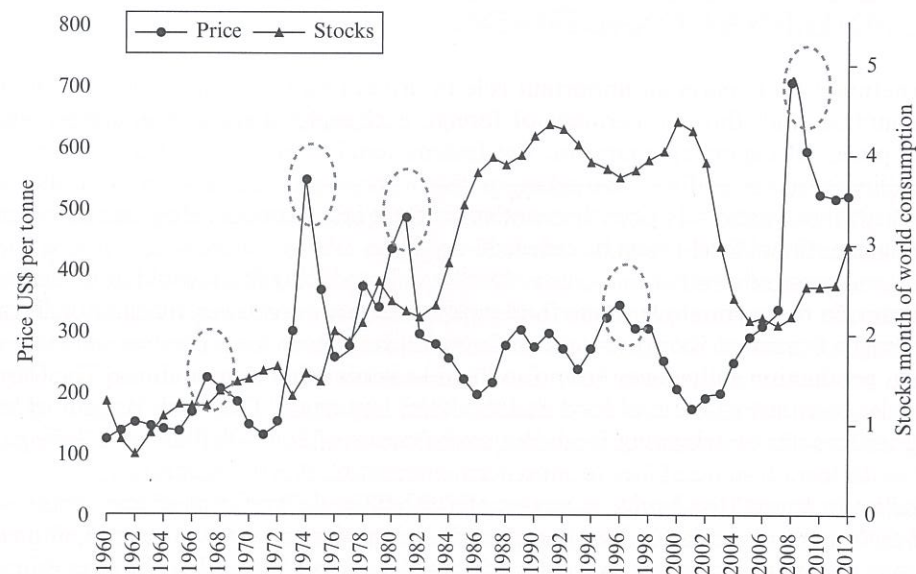


Unfortunately, the responses of individual countries to fluctuations in food prices have in some cases accentuated the volatility of the international market. When the international price of rice increased in 2007–08 both exporting and importing countries attempted to shield their domestic consumers from the high international prices. Some exporters restricted the quantities that could be exported and some importers reduced tariffs and increased public sector purchases. Although the aim in both cases was to stabilize domestic prices Martin and Anderson (2011) have shown that the effects were at least partly offsetting. Both sets of policies reduced domestic prices relative to international prices but they had reinforcing effects on the international price itself – raising it well above the level it would have reached in the absence of these protectionist responses. For the international rice market to play its important stabilizing role, means must be found to discourage these beggar-thy-neighbor protectionist responses.

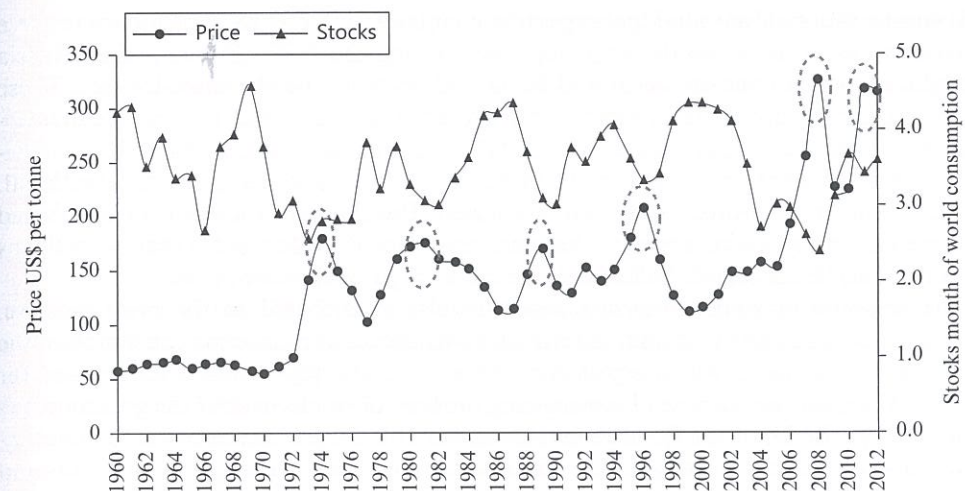
The discussion that follows focuses on the role of stocks. Price spikes tend to occur when the level of stocks is unusually low. The discussion asks whether action to raise the level of stocks could play a constructive role in stabilizing international food prices. Following Galtier (2012), Figures 14.9, 14.10 and 14.11 combine information on the international prices of rice, wheat and maize since 1960 with data on stocks for these three commodities, respectively. A striking point emerges. Consider the periods when prices spiked for each of these three commodities. These periods are marked with circles. There were three such periods for rice and five each for wheat and maize. Now consider the periods when stocks were lowest. They coincide. Prices spiked when stocks were lowest and only then.

The level of private stocks is determined by the business decisions of people who hold these stocks for the purpose of making profits (Williams and Wright, 1991; Wright,



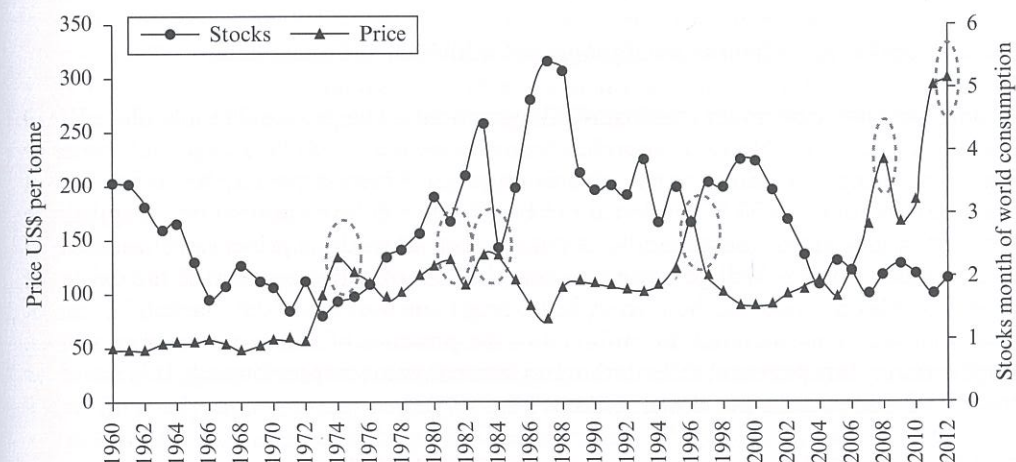
Source: Stocks, US Dept of Agriculture; prices, International Monetary Fund.

Figure 14.9 Rice: international prices and stocks, 1960 to 2008



Source: Stocks, US Dept of Agriculture; prices, International Monetary Fund.

Figure 14.10 Wheat: international prices and stocks, 1960 to 2008



Source: Stocks, US Dept of Agriculture; prices, International Monetary Fund.

Figure 14.11 Maize: international prices and stocks, 1960 to 2008

2011). But at times the level of stocks that emerges from this market-driven process is too low, from a social standpoint, because it increases the likelihood of price spikes that have harmful consequences. That is, there is a market failure in relation to the level of privately held stocks. The harmful consequences are not only that poor people suffer from food insecurity induced by the spike in prices. But the responses of individual national governments can magnify the problem. This can happen in both exporting and importing countries.

It can be rational for individual exporting countries to introduce export bans in these circumstances. This is exactly what happened during the 2007–08 crisis, when Russia introduced export bans on wheat and India and Vietnam did the same for rice. These export bans were motivated by the desire to protect domestic consumers from high international prices. Although there was a great deal of international criticism of these decisions, the reasoning behind the introduction of the bans is easily recognized and rational. Governments must protect their own consumers. But the bans themselves exacerbated the international price instability. It has been estimated (Headey, 2011) that export bans were responsible for almost half of the international price increase of rice.

The response of some importing countries also contributed to the price increase. Fearful of being unable to obtain the rice that was needed for domestic consumption the Philippines (then the world's largest importer of rice) sharply *increased* its demand for imported rice, for the purpose of replenishing the level of stocks held by the government's food agency, the National Food Administration. This further exacerbated the international price increases. Headey (2011) estimates that between them, the export bans and the panic buying by some importers almost fully explains the price increase for rice.

The point is that these government responses were not necessarily irrational from their own national points of view. But their global effect is to magnify the volatility of the international food prices concerned. Is it possible for public action to address this market failure?

14.4.1 Option 1: An Internationally Agreed Prohibition of Export Bans

Export bans are legal under existing WTO agreements. The proposal to introduce WTO prohibitions on export bans for food has been discussed at the G20 level and it is possible that some progress could be made on this proposal. These steps may be desirable, but it is not apparent that WTO action could be effective. If international prices spike, the very survival of governments can be at stake if they allow these prices to be transmitted to domestic markets. Will governments risk the loss of office because of the existence of WTO rules prohibiting them from insulating their own domestic markets? It is not clear that the proposal could be enforced in the presence of international price spikes. Furthermore, this proposal does nothing to prevent panic import buying. It is not clear that WTO action can solve the problem.

14.4.2 Option 2: International Cooperation to Stabilize Prices

Is it possible for international institutions to stabilize prices, to prevent these bubbles from occurring in the first instance? If prices were maintained within internationally agreed bands there would be no need for exporting countries to ban exports or for importing countries to engage in emergency buying. That is, food price panics could be averted.

Unfortunately, the history of International Commodity Agreements (ICAs), directed to just this objective, is sobering. Examples include agreements to stabilize the international prices of cocoa, natural rubber, coffee and sugar. They all collapsed. The central problem is that the institutions concerned have tended to become dominated by producer interests who see them as a means to *support* prices, by raising their mean levels,

rather than just a means to *stabilize* prices, by reducing their variance. The result was over-production. High international prices could be maintained only by purchasing huge quantities of the commodity concerned, which was then stored at great cost. As this process continued, excessive amounts of money were eventually needed to purchase the huge stocks required for continued price support. When the funding became insufficient, the scheme collapsed. For international stabilization to work, the tendency to support prices, rather than simply to stabilize them, would have to be resisted.

There is a further problem. For panic responses to be averted (exporters and importers), governments must be able to trust the governance of the price-stabilizing institutions. Is this possible? The prospect for success could be greatest at the regional level, focusing only on regionally important commodities. For the Asia-Pacific region, this means rice. Southeast Asia contains both the world's largest importers or rice (the Philippines and Indonesia) and the largest exporters (Thailand and Vietnam). Their interests diverge. Would regional management of a rice price stabilization scheme be capable of avoiding the fate of ICAs elsewhere? The proposal is worthy of close study, but the cost of failure would be high and caution is essential.

14.4.3 Option 3: Higher Levels of Stocks Maintained by Individual Governments

When the government owns the stocks itself, there is no need to trust international agreements. The proposal is therefore that governments maintain stocks for emergency purposes. These would be released only in a transparent, pre-announced manner and only when prices are unusually high. This is a costly activity. Private storage of rice is generally done only between seasons within the year. Storage from one year to the next is costly and significant deterioration occurs after about two years.

Moreover, it must be recognized that domestic price stabilization can be achieved only in the presence of trade restrictions that prevent transmission of international prices to the domestic market. Suppose international prices of rice surge, as they did in 2007. An importing country might release stocks of rice onto the domestic market to force the domestic price to levels below the international price, but this would be effective only if exports were prohibited. Otherwise, it would be profitable for private agents to buy rice domestically at the now lower domestic price and sell it internationally at the higher price. Similarly, an exporting country would need to restrict exports to stabilize domestic prices. But this is exactly the policy action that a WTO ban on export restrictions (Option 1 above) would prohibit.

14.4.4 Option 4: No Intervention in Domestic Prices Combined with Cash or In-kind Transfers

Because of the computerization of transfer systems using the bank accounts of potential recipients, it is now possible to make cash transfers in a targeted manner. Further progress can be expected. When the international price surges, emergency relief could be provided to the poorest consumers (at least, those with bank accounts) in this manner.¹ But does this resolve the political problem of the government concerned? Suppose that when the international price increases the poorest consumers are indeed protected in this manner. What about the urban middle class? They must bear the cost of both the higher

international prices and the fiscal burden of insulating the poor from the price increases. But the urban middle class is perhaps the group most feared by governments. While this option has much to recommend it, for the majority of the population the basic problem of food insecurity is left unresolved.

14.5 ENHANCING FOOD SECURITY THROUGH POVERTY REDUCTION

The second of the three drivers of food security is poverty reduction. The concepts of food (in)security and poverty incidence are closely related, but differ in some important respects. First, poverty incidence refers to the adequacy of otherwise of consumption of a wide range of goods, of which food is the paramount example, but not the only one. Studies determining 'poverty lines' – the levels of expenditure per person below which an individual or household is deemed to be poor – focus in particular on the level of total expenditure that coincides with dietary adequacy. Still, the fact that food is only one component of the goods and services making up the poverty line means that it is possible in principle for a poor person to be food secure and for a non-poor person to be food insecure.

A second, and more subtle, difference is that poverty incidence refers to the circumstances observable in the present. At the time the household is surveyed, consumption levels of food and other essential goods either are or are not adequate. If they are not, the household is deemed to be poor. But as argued above, food security refers more particularly to expectations about the future than to the circumstances of today. Individuals or households may judge themselves to be food insecure to some degree, even if their present level of food consumption is sufficient. 'Vulnerability to poverty' is conceptually closer to food insecurity than 'poverty incidence'. But vulnerability to poverty is a statistical concept, based on objective circumstances observable in the present, whereas food security is inherently more subjective, because it involves expectations about the future.

Despite these differences, the concepts of food insecurity and poverty are closely related, and undoubtedly very highly correlated. Food security is overwhelmingly an issue of purchasing power. Poor people are the most likely to be hungry. Measures that reduce poverty are likely to improve food security and vice versa. The rich do not go hungry in any country, except during wars, politically caused famines or natural disasters. Even then, the poor suffer more. Hunger is mainly due to poverty. This general conclusion requires qualification. Despite the empirical and theoretical presumption that poverty reduction generally leads to improved nutrition, exceptions have been identified.

14.5.1 A Counter-example From India?

Between 2004–05 and 2009–10, a period of rapid economic growth in India, measured poverty incidence declined rapidly, but average caloric intake apparently declined. These observations seemingly depart from the generalization that poverty reduction leads to improved nutrition. Data on other nutritional indicators are not yet available for 2009–10, so it is not yet known whether other relevant indicators, including

Table 14.2 *Poverty reduction and reduced caloric intake, India, 2004–05 to 2009–10*

	Poverty incidence (headcount measure)		Average caloric intake (Calories per day)	
	Rural	Urban	Rural	Urban
2004–05	41.8	25.7	2047	2020
2009–10	33.8	20.9	2020	1946

Source: Himanshu (2012), based on data from National Statistical Organisation, Government of India, *National Statistical Survey*.

protein intake, also deteriorated. Himanshu (2012) reviews the evidence, summarised in Table 14.2, above, and discusses some possible explanations for this apparent paradox.

No single explanation has yet gained wide acceptance. Patnaik (2010) and Gaiha et al. (2010) point to possible explanations arising from deficiencies in the available data. Lower demand for calories may have been caused by declining real income levels caused by rising food prices, where the rising prices were not properly measured by the methods used in constructing the poverty line. Since 2005 the statistical basis for measuring poverty in India has changed from the previous Lakdawala method, developed in 1993, to the Tendulkar method, based on a review of poverty measurement in India completed in 2005. A major component of these changes relates to the measurement the poverty line, particularly the replacement of consumer price indices, based on market prices, with unit value indices, extracted directly from the consumer expenditure surveys used to measure household expenditures. This change occurred during a period in which consumer prices were rising. If the rate of food price inflation was understated by the use of unit value indices the increase in the nominal value of the poverty line would be understated and the rate of poverty reduction would be overstated, possibly resolving the paradox.

Use of unit value indices in place of market prices can provide a misleading indicator of changes in the cost of living. Suppose food prices are rising relative to other prices, as in this period in India. Poor consumers may respond by switching to lower quality, lower priced caloric sources. The use of unit values may wrongly record this switch as a decline in the price, or at least a smaller increase than the true increase in the price of food of a given quality. The rate of increase of the poverty line will then be lower than the true increase in the cost of living, meaning that the rate of poverty reduction will be overstated.

A second set of issues relates to the way India's system of public distribution of subsidized food is allowed for in the measurement of both poverty incidence and caloric consumption. Much of the statistical discussion in India has focused on this set of issues. Because use of the public distribution system has expanded over time, it is possible that imperfect allowance for its nutritional impact may have contributed to the apparent paradox of declining poverty incidence together with the absence of improved nutrition, at least among some groups.

A more worrying explanation is also possible, one that does not treat these findings for

India as statistical anomalies. Periods of rapid growth often lead simultaneously to both reductions in poverty incidence and increased inequality. This was apparently especially true of this recent period of rapid growth in India. The headcount measure of poverty incidence declines over time when the number of households whose real expenditures move from below to above the poverty line exceeds the number moving in the opposite direction. That is, it depends only on changes occurring in the neighborhood of the poverty line. This says nothing about what happens to the very poor (who remain below the poverty line) or the non-poor (who remain above it).

As shown by Deaton and Drèze (2009), among higher income groups in India the expenditure elasticity of demand for calories tends to be negative. That is, as their total expenditures rise their diets may improve, including higher intake of protein, partly from animal sources, but total caloric intake declines, due to a dietary switch away from staple foods. This partly reflects a change in the physical requirements of work and other dimensions of improved living standards. Among lower income groups, especially those with expenditures below the poverty line, this is not the case. As their incomes rise, their average caloric intake also rises, and vice versa; as their incomes decline, their average caloric intake declines.

Now suppose that increased inequality meant that higher real expenditures were enjoyed primarily by better-off income groups, who remain above the poverty line, with some gain to those in the neighborhood of the poverty line, causing the observed reduction in the headcount measure of poverty. But there may have been little or no gain in real expenditures among the poorest groups, who remained below the poverty line. There could even have been a reduction in the real expenditures of households well below the poverty line because their money incomes failed to keep pace with the rapid increase in food prices that occurred during this period. The reduction in the average caloric intake of the better-off, combined with little if any increase in the caloric intake of the poorest groups, could be sufficient to cause the observed reduction in the average caloric intake of the whole population. This could occur even though the average caloric intake of households in the neighborhood of the poverty line increased. That is, the finding of reduced poverty incidence coexisting with reduced average caloric intake may reflect an increase in inequality, especially among the poor.

14.6 ENHANCING FOOD SECURITY THROUGH SOCIAL FOOD SAFETY NETS

The efficiencies and dynamism that accompany market processes are demonstrated sources of economic progress. But impersonal markets leave some segments of the population outside the set of beneficiaries. This is especially true in an environment of highly unequal asset ownership and capacity to participate in the market economy. Social safety nets are mechanisms to assist people in need. Access to food is necessarily a central focus. Recent increases in the volatility of food prices make these schemes even more critical for the avoidance of unnecessary suffering. Most Asian countries employ safety nets of some kind, intended to shield poor and vulnerable groups from severe deprivation. But their effectiveness depends on their capacity to target the poor and in this respect existing schemes have major deficiencies.

As a percentage of GDP social protection expenditures vary among Asian developing countries from 1.3 (Lao PDR), 1.9 (Indonesia), 2.2 (Philippines), 4 (India) 5.3 (Bangladesh) and 9.8 (Mongolia). In 10 out of 32 Asian countries the share is 2 percent or less. On average, poorer countries allocate lower proportions of GDP to social protection expenditures. In the United States the share is 9 percent, in Japan 16 percent and in the European Union it is 19 percent.

Jha et al. (2012) review existing social safety net schemes in four of the above countries: Bangladesh, India, Indonesia and the Philippines. The major categories of safety net programs are consumer food price subsidies, food-for-work programs, feeding programs and cash transfers. The authors find major problems in existing targeting systems. Within the subsidized food programs, which exist in all four countries, they describe high rates of both exclusion error (omitting households who qualify for inclusion) and inclusion error (providing assistance to households who do not meet the criteria for inclusion).

In India, the Public Distribution System for subsidized access to grains is said to entail both exclusion and inclusion errors of 70 percent. Similar rates of inclusion error are reported for Indonesia's Raskin (food for the poor) program and the Philippines subsidized food program under the National Food Authority, though exclusion errors are somewhat lower at 29 percent (Indonesia) and 52 percent (Philippines).

These data do not necessarily demonstrate that the existing programs are worse than nothing, because some of the benefits do reach the intended beneficiaries. Nevertheless, the wastage and corruption associated with them is a serious concern and raises the question of whether the objectives of the programs could be attained more efficiently in another way. The fiscal stimulus expenditure programs and reduced government revenues that followed the Global Financial Crisis of 2008–09 have reduced the fiscal space available to national governments throughout Asia and increased the urgency of finding better ways of using public money.

The evidence points to regional and ethnic biases in the existing allocation schemes and practical problems in identifying the qualifying households, along with simple corruption. Sale of subsidized grain is apparently widespread, but this is not necessarily a problem if the sellers are the poor recipients of the grain themselves, who sell it to obtain other commodities or food of higher quality. It is a serious problem if the sellers are the public officials charged with distributing the subsidized grain. Overall, the failure of targeting of the existing systems raises the question of whether the programs might not be replaced by something better.

Jha et al. (2012) ask whether a cash transfer system might not be used to replace these in-kind programs altogether. Practicalities aside, political resistance could be expected. There are beneficiaries from the existing corruption and inefficiency, and these beneficiaries can be expected to oppose change. The practical problems are vast, but new technological developments promise the possibility of solutions. The simplest systems use the existing banking and post office systems to distribute cash to targeted groups. A problem arises when these facilities are not readily accessible. Within Africa, mobile phone systems have been used widely for this purpose. Any retail outlet can then be used as a distribution center for cash. Conditionality relating to school attendance and participation in health centers is possible within a cash transfer system and these systems have been well developed in Latin America. New systems of biometric

identification and smart cards can be used to reduce fraud and enable the programs to deliver benefits to the target population. Better ways to identify eligible households might be combined with these systems. The existing systems are not working. In the Philippines, half of the households eligible for food subsidies are not receiving them at all.

Indonesia has already demonstrated the possibility of implementing cash transfers to compensate for economic shocks. The world's largest unconditional cash transfer system was introduced in 2008 to compensate Indonesian households for the impact of reductions in petroleum product subsidies. With the assistance of the World Bank, Indonesia was able to develop a system that achieved its objectives in a transparent manner. There is scope to build on that well-documented experience.

Overall, it seems very possible that new information technology can be used to provide social safety net programs more efficiency and with less corruption. It may be possible to dispense altogether with the need to redistribute food in kind, replacing it entirely with cash-based systems. Reducing the corruption associated with social safety nets is important, not only because of the direct fiscal implications, but also because corruption is not invisible. It reduces public support for these programs, at the expense of those who genuinely need them.

14.7 CONCLUSIONS

This chapter has argued that food security is a meaningful and important concept because of the special characteristics of food as a commodity. It is argued that food security is enhanced by three things:

1. *Reductions in the real price of food.* The chapter discusses the role of agricultural productivity enhancement through research and extension and through investments in rural infrastructure. The role of international trade in determining domestic food prices is also discussed, along with means of averting domestic food price spikes due to international price increases.
2. *Reductions in poverty incidence.* Under most circumstances, only the poor suffer from food insecurity. By increasing the real purchasing power of the poor they can be self-insulated against food insecurity.
3. *Establishing effective food social safety nets.* Some groups lie outside the reach of the forces of economic growth and poverty reduction. They require special assistance, especially with regard to food. Emergency food safety nets are also required in case of natural or anthropogenic disasters.

NOTE

1. See the World Food Programme study (Gentilini, 2007) for a critical review of the issues involved.

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15. Best-fit options of crop staples for food security: productivity, nutrition and sustainability

Jill E. Gready

15.1 INTRODUCTION

15.1.1 Definition of Problem and Approach of this Chapter

Provision of sufficient nutritious food to feed the world's growing population is the most important problem facing the world, more so than energy. Several authors argue history shows that primary causes of survival crises are food shortages (Brown, 2012). By 'sufficient' and 'nutritious' here we mean sufficient for caloric (energy) needs, and nutritious as the quality (essential amino acids and micronutrients) necessary for childhood development and maintenance of health.

In this chapter we analyse this broad statement from multiple angles, with the aim of placing possible food-crop options, and agricultural and biotechnological solutions in context. The approach taken is to sketch the scale of the food supply and security problem, and dissect the interconnectedness of factors impacting on it, focussing on those critical for efficient, reliable and sustainable crop production and yield, and nutritional quality. We then examine the options, limitations and risks of crop-choice and -improvement options, including application of biotechnological methods.

Our starting thesis is that existing analyses are too piecemeal to represent the complexity of the problem adequately; thus, they do not provide a basis for understanding the interdependencies of contributing factors. This mode is represented, for example, by a special issue on food security in *The Economist* (2011). It presents the major issues in a series of synopses: 'The 9 billion-people question' (SS3-5); 'How much is enough' (SS5-8); 'Plagued by politics' (SS6; biofuels); 'No easy fix' (SS8-11; resources – pessimistic); 'Waste not, want not' (SS10; waste, spoilage); 'Doing more with less' (SS11-14; resources, seeds – optimistic); 'Crisis prevention: future of food' (SS12; prices, research investment); 'Our daily bread' (SS13; UK wheat-research lobby); 'Not just calories' (SS15; nutrition); 'A prospect of plenty' (SS16; not easy to solve but possible – upbeat). However, it makes no attempt to integrate these disparate views. If this had been done then the inconsistencies of proffered solutions and the risks of pursuing, or not pursuing, some options would start to be apparent.

We argue that in the absence of this framework, it is not possible to 'see' the best possible solutions nor to assess the value of their success or the risks of their failure to assuring food security or reducing food insecurity. Solutions currently proffered are mainly evolutionary rather than revolutionary, and unlikely to meet the scale of the problem, while others are technically unrealistic, unnecessarily complex or require a level of international cooperation and national management that, to date, has proven difficult to achieve or sustain. To a large extent they represent the existing vested interests