Prometheus
Vol. 29, No. 3, September 2011, 309–324

Routledge
Taylor & Francis Group

BOOK REVIEWS

Foresight: the future of food and farming, final project report, by Government Office for Science, London, 2011, 208 pp., ISBN 978-0-7546-7248-7

I suggest that minimum requirements for a global food and farming system fit for purpose are that:

- it should ensure that the world's current 6.8 billion population (anticipated to rise to over 9 billion by 2050) has access to sufficient food to enable each member of this huge population to live healthily and
- the very substantial resources needed to achieve this should be secured without causing more than the minimum of damage to the environment of the small planet we inhabit, and to biodiversity.

This report includes a large quantity of statistics and other data which demonstrate that, far from being fit for purpose, the world agricultural and food production and distribution system is dysfunctional, in terms of both its failure to provide and distribute the food necessary for keeping the world's population healthy, and of minimizing environmental damage.

Statistics in the report show that only 57% of the world's population consumes a reasonable amount and quality of the food needed to keep in good health. About 28% receive too little food, and about 14% consume too much (pp.9–10). Economic growth and technological change have combined to lift hundreds of millions of people out of poverty and severe deprivation. However, there are still many people who suffer from severe deprivation – hunger, starvation and poor health. These are people who have insufficient land on which to grow food for themselves and their families, together with those who are unemployed and cannot afford to buy food.

The report estimates that 925 million people out of a world population of 6.8 billion experience hunger in terms of lack of access to sufficient of the major macronutrients – carbohydrates, fats and proteins. Perhaps another billion suffer from 'hidden hunger' in which important micronutrients, such as vitamins and minerals, are missing from their diet, bringing risk of physical and mental impairment. In contrast, about a billion people consume far too much than is good for their health and are suffering from chronic conditions, such as type 2 diabetes and cardiovascular diseases, as a consequence.

The report also notes that there are widespread problems of soil erosion, loss of soil fertility, salination and other forms of degradation. Rates of water extraction for irrigation exceed rates of replenishment in many places. Over-fishing is widespread. The sector relies heavily on fossil fuel derived energy for synthesis of nitrogen fertilizers and pesticides. Meat consumption is rising fast, particularly in developing countries. Producing meat – especially from intensively raised grain-fed animals – is

ISSN 0810-9028 print/ISSN 1470-1030 online
http://www.tandfonline.com

very expensive in terms of the resources required to yield a given amount of nutrition, and in terms of environmental pollution.

As a basis for showing how such serious problems can be solved – or at least alleviated – the report needed to provide an historical account of how and why such problems have arisen, and to present a coherent analytical framework outlining the key interactions between the various complex factors that affect the food and farming sectors of the world economy. Instead, chapter 2 presents an inadequate, unsystematic account of 'key drivers of change', which it fails to situate in historical context. These omissions deprive the report of a sound basis for formulating proposals for future policy directions.

The report could also have put more emphasis on the fact that global farming and the other industries with which it is closely associated (such as fertilizer and pesticide production and food manufacture, marketing and distribution) are controlled mainly by large multinational corporations pursuing profits. It is in the interests of these organizations to increase the size of the huge, diverse markets that are the principal source of the profits, which it is their over-riding aim to secure.

I suggest that markets for food are increased by corporations stimulating demand by the use of marketing and promotion. This results in increases in the use of physical resources, which, in turn, increases damage to the environment. Obesity is a complex problem, but is probably partly a consequence of intense, successful marketing efforts by major multinational corporations to sell large quantities of highly calorific foods to people who already consume more than enough food to meet their nutritional needs. The worldwide increase in meat consumption is by no means an independent, autonomous 'cultural' change. It owes some of its rapidity to the intensive worldwide marketing efforts of corporations such as McDonald's and KFC. Reducing the adverse effects of their activities on the environment and on biodiversity is of secondary interest to major multinational firms. Accordingly, effective restraint on damage to the environment and to biodiversity has to be exercised, mainly through regulation by nation states and/or international organizations. Inherently, these processes are inefficient because limiting environmental damage and damage to biodiversity are fundamentally in conflict with the strong drive for profits of large multinational corporations.

The report should have considered historical factors in greater depth. Since the mid-twentieth century, powerful agricultural technologies have been developed by scientists in international research centres (primarily in the US), adapted in national research institutions, adopted by extension agencies and agro-chemical and seed companies, and marketed to farmers (Senker, 2000). These technologies include uniform high-yield crops, mechanical and energy inputs and synthetic chemicals. They tend to reduce indigenous biodiversity and are not designed for small resource-poor subsistence farmers. They have benefited middle-income farmers in some developing countries, and many claim that the overall development impact in specific contexts has been positive.

Initially, this Green Revolution was based on breeding dwarf varieties of wheat capable of producing spectacular yields under ideal conditions. Similar developments were applied subsequently to rice. Growing high-yielding varieties involved securing large supplies of fertilizers and pesticides, which generally have to be imported by developing countries from developed countries, principally the US. Growing these crops requires more frequent and more precise irrigation. Farmers had to ensure the necessary inputs were available. This was enough to exclude all

but the largest farmers from the benefits of the Green Revolution (George, 1976; Patel, 2007).

The Green Revolution was adopted mainly by farmers who met the needs of urban areas or export demand for food, rather than by poor rural farmers who needed to feed their families. It contributed to the erosion of genetic variety in food systems. Reliance on chemical fertilizers resulted in new 'ecological diseases', and has also made the food production of developing countries dependent on expensive imports of agro-chemicals and machinery. The Green Revolution contributed to global food security in terms of increasing available food supply, but it failed to address specific food security needs at household, intra-household and community level. It was partially responsible for entrenching an unsustainable food production system favouring monoculture and exacerbating environmental degradation, biodiversity reduction and unequal distribution of resources.

Initially, the Green Revolution increased the need for labour to spread fertilizers and pesticides, and to gather in two harvests per year instead of one. But gradually, as in the US, machines were used by large farmers to reduce their costs, thus reducing the demand for labour and the number of people able to benefit. The move to a higher input environment favoured those farmers who had access to capital and skills. These farmers strengthened their role at the expense of less well-endowed groups. The established roles of women in farming systems were challenged by the new technology and the new economic structures, as work previously performed by women was taken over by machines.

The Green Revolution helped US corporations dominate developing country agriculture, including the pattern of crops planted, supply of technology and inputs – particularly fertilizers, pesticides and seeds. It did not directly influence rain-fed farming systems, whose production can be adversely affected by droughts. As a result, income disparities between irrigated and rain-fed villages and regions worsened. The prospects for significant technological advances in rain-fed areas are hampered by limited and uncertain rains that often make water a critical constraint in plant growth, and by diversity of local growing conditions, which limits the geographic applicability of improved technologies. This resulted in increased inequality in terms of living standards between farmers who could afford to buy the necessary inputs, and those who could not. Moreover, the gains have tailed off. Salination of irrigated areas, pest increases, declining returns to input applications and water supply problems hit hard. In the midst of surplus, there are still people who cannot gain access to food, for example, because they lack access to land.

During the 1990s, some major multinational corporations claimed that genetic engineering would increase the productivity achieved by farmers in developing countries and alleviate poverty and hunger, the 'Gene Revolution'. However, research has been concentrated in areas thought likely to open up big markets in developed countries, rather than in developing countries, where the need is for drought-resistant crops for marginal lands, and for foods that have a high nutritional value. Few of the foods produced so far are foods that the hungry can afford. Biotechnology companies have concentrated on a restricted range of crops that offered large and secure markets and involved capital-intensive production systems. The transgenic crops which they developed were patented. World Trade Organization rules prevent farmers from reproducing patented seeds that they harvest themselves. Efforts by a US company to patent basmati rice caused outcry and highlighted the potential dangers and absurdities involved in new patenting arrangements.

Accordingly, many argue that the application of intellectual property rights protection to crops may well have negative consequences for poorer farmers (Commission on Intellectual Property Rights, 2002; Senker and Chataway, 2009).

A transition from the Green Revolution to the current Gene Revolution is widely seen as the key to development, but the report does not consider this explicitly. Technology-driven economic growth through sustained innovation and trade is envisaged as providing pathways out of agriculture, or a shift from subsistence-oriented 'old' agriculture to a modern, commercial 'new' form of agriculture, with wider poverty reduction aims achieved through trickle-down and employment benefits from improved agriculture-led growth.

Advocates of biotechnology argue that its application can help to increase production, reduce costs and improve product quality. They suggest that biotechnology could have major impacts on reducing poverty, boosting incomes and employment opportunities in poor rural areas. But so far, the development of agricultural biotechnology has been driven principally by commercial interests and has resulted mainly in standard solutions that involve expensive external inputs and reductions in crop diversity. High levels of inputs, such as fertilizers and pesticides, together with the reduction of biodiversity that tends to result, are liable to have adverse effects on the environment.

Key elements of the modern food and farming system involve a wide array of external expensive inputs, such as research and development, fertilizers, seeds and irrigation, together with reductions in crop diversity. Corporations are likely to continue to push biotechnology, perhaps with some success. But, it is doubtful whether biotechnology will make major contributions to food security in the developing world unless there are radical changes in the present directions of economic and technological development.

Nevertheless, the report does acknowledge that there are about a billion people currently in developing countries for whom poverty and landlessness deprive of the basic necessities for pursuing a healthy life. I suggest that solutions to this problem could well require that technology and societal choice be more closely entwined. This could involve participation of local farmers in technology choice. Agricultural research should serve small farmers better, and involve the development and application of a wider range of technologies requiring low inputs adapted to varying needs and contexts. Some organic farming and some biotechnology could be included in a programme aimed at benefiting the poor in an 'Evergreen Revolution'. Such alternative visions emphasize working with natural systems, generating improved livelihoods with more ecologically attuned production systems (Scoones, 2006; Thompson *et al*., 2007). Public–private partnerships might play a role in this. Local and traditional knowledge are key to agricultural innovation in developing countries and would therefore be important (Senker and Chataway, 2009). Agricultural innovation needs to be based on local and traditional knowledge, cultural preferences and local environmental conditions.

The report includes a wealth of statistical and other data, together with bibliographic references, but it lacks historical perspective and a coherent analytical framework. These limitations make it difficult for it to succeed in its aim of identifying 'the decisions that policy makers need to take … to ensure that a global population rising to nine billion or more can be fed sustainably and equitably'.

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© 2011 Peter Senker
http://dx.doi.org/10.1080/08109028.2011.628564

Beyond intellectual property. Matching information protection to innovation, by William Kingston, Cheltenham, Edward Elgar, 2010, viii + 247 pp., £65.00, ISBN 978 1 84844 992 3

In many ways, this book marks the pulling together of the breadth and depth of knowledge acquired during Kingston's lengthy career studying innovation. It is firmly rooted in an academic consideration of the nature of information and how this contrasts with (and does or does not impact on) knowledge. Yet, it also takes as a starting point the many cogent criticisms of the state of government intervention to provide monopolies for information and focuses on practical means of improving outcomes for smaller firms. Kingston considers that, despite a clear need for radical reform, political impediments mean that the existing broken systems of patents, copyright and trademarks must be accepted. He also takes as a given that 'protection' is required for new information used in the marketplace. He proposes solutions that work around – or undermine – these systems.

After reminding readers that information has several characteristics often glossed over – particularly that information as it is received and acted on differs between each recipient – he notes the important distinction between information and knowledge. In discussing creativity and copying, his focus is very much on the economic use of new meanings attached to information. He accepts, perhaps too readily, Hardin's version of the 'tragedy of the commons' – though in practice, the commons were always subject to social norms and controls that prevented over-grazing. The real tragedy can be seen as the enclosure of the commons. However, given his take on over-grazing, Kingston makes the presumption that protection is essential