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Authors	Sage, Colin
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Colin Sage

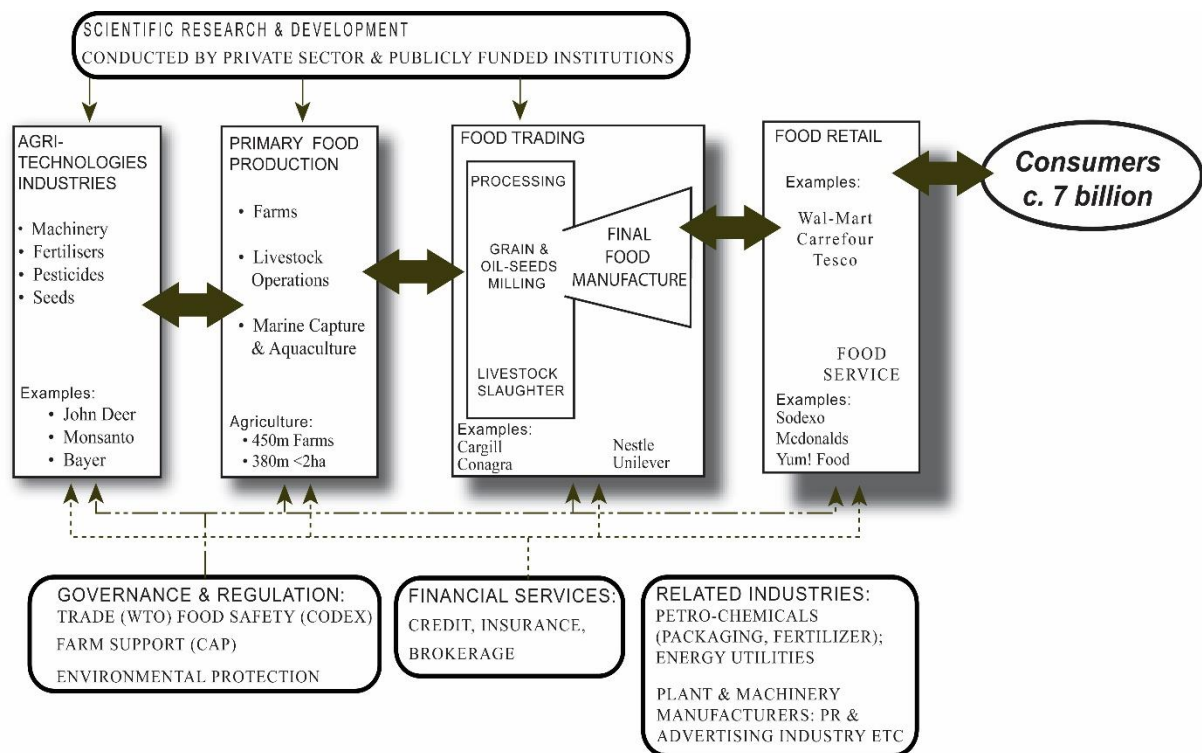
The agro-food system comprises all those activities related to the production, processing, distribution, sale, preparation and consumption of food. The prefix 'agro-' (or 'agri-') to the term 'food systems', however, invites us to place somewhat greater importance upon the farm sector and the production of *primary* foods than to subsequent stages where these materials are refined, manufactured into *final* foods for ultimate consumption. Moreover, as Robinson (2004) reminds us, agriculture is distinct from many other economic activities as it deals with living organisms, that is the plants and animals that possess particular biological characteristics. The degree to which these are adapted to the prevailing environmental conditions will largely determine their productivity. Consequently, agro-food systems encourage us to pay attention to their particular geographical context. Yet while climate, moisture, soils and other ecological services provide the key physical parameters of production potential, farmers influence this environment through limiting biological (and genetic) diversity and managing inputs to create a farmed *agroecosystem*. The nature and extent of farmer intervention is itself a consequence of the social and economic circumstances in which they find themselves, such that agricultural systems can range from extensive, low-input cultivation to highly intensive and industrialised operations. An understanding of agro-food systems must consequently appreciate the array of environmental and socio-economic factors that influence the ways in which these systems develop.

Global or local agro-food systems?

We have come a very long way since the time when subsistence farming to meet household needs prevailed around the world. While there may be some isolated pockets of self-provisioning remaining, most farmers are in the business of producing surpluses for sale into markets. While these were, and for many remain, oriented to the supply of local towns and cities, elsewhere we have witnessed a growing sophistication and distance covered by food

supply chains. Indeed, accompanying the process of trade liberalisation from the 1980s onward has been a growing enmeshment of farmers in international markets such that we now commonly refer to a singular 'global agro-food system'. This term reflects a complex and dynamic intensification of worldwide relations involving food and agriculture underpinned by a raft of global agreements in trade, intellectual property rights, financial investments and food safety regulations. The conclusion of the Uruguay round of trade talks in 1994 that led to the creation of the World Trade Organisation was especially significant in forcing the removal of protective measures (tariffs) that defended domestic farmers from large volumes of low-cost surplus food staples. Together with the imposition of structural adjustment programmes that strongly encouraged the pursuit of export revenues, such policy measures had the effect of realigning the agricultural sectors of many countries away from domestic staples and toward high value export crops.

Invariably this enabled some of the largest companies with a presence on international markets and recognised brands and services to establish themselves in many more countries worldwide. This has become a feature of every stage of the entire agro-food system: from agri-technology suppliers of machinery, seeds and chemical inputs; through the 'merchants of grain' such as Cargill and ConAgra; food processors and product manufacturers with their globally branded soft drinks, snacks and other convenience products; fast food franchises and, ultimately, supermarkets catering to the rising numbers of middle-income consumers in cities worldwide. It is no exaggeration to state that the parameters and modus operandi of each of these stages has been set by a relatively small number of large corporations that now exercise a global reach all the way to the farm sector in distant countries. Each of these stages are represented as discrete boxes in Figure 1 which also indicates the complex array of financial and regulatory arrangements that underpin and have enabled the development of the global agro-food system.



Yet such globalisation is not simply measured by rising volumes of internationally traded agricultural commodities but reflects more profound changes within the realms of food production and consumption. The expanding application of advanced agronomic science and technology – such as plant and animal genetic engineering and precision farming involving big data analytics - demonstrates how the locus of power is moving off the land. Developed for the purpose of maximising agricultural output, rather than meeting local food and livelihood needs in sustainable ways, such technologies easily displace the empirically-derived and context-specific knowledge of farmers that has evolved over generations and which has served to sustain their livelihoods in risk-prone environments. Yet, the challenges faced by farmers in many very different regions around the world are becoming more complex, intractable and reflect dynamic interactions arising from a spectrum of environmental and socio-economic factors. In particular, climate change, freshwater depletion, loss of topsoil, biodiversity loss and rising levels of food-related waste demonstrate that, in contrast to the imposition of inappropriate technologies, knowledge-based innovations responding to *local conditions with local resources* are likely to provide for more sustainable, equitable and capacity-enhancing solutions in an era of global environmental change (Thompson and Scoones 2009).

Widening the frame of analysis

The proponents of the existing global agro-food system are keen to point out that it has delivered more calories for a lower proportion of consumer spending than ever before and has diversified the diets of a majority of the world's population too, a process generally known as the nutrition transition. But overall the evidence suggests an unsatisfactory performance given the environmental cost, for 800m people in the world are suffering from hunger, two billion more are affected by micronutrient deficiencies, while a further 1.9 billion are classed as obese or overweight and susceptible to a range of non-communicable diseases (WHO 2016). More people die today from diet-related ill-health than any other cause of premature death: a consequence of a food system busy promoting foodstuffs that do not optimise human nutrition and well-being.

For this reason, it is becoming increasingly necessary to adopt a much wider – indeed a holistic – perspective on the agro-food system, one that understands that its problems are deeply interconnected and mutually reinforcing. In my local supermarket in Ireland I can find green beans from Kenya and asparagus from Peru, two countries that appear to have successfully embraced the opportunities offered by non-traditional, high-value fruit, flower and vegetable contract production for the major supermarket chains in the global North. Yet while both countries' export earnings have grown significantly over the past two decades, this commodity 'boom' rests upon extremely fragile water resource endowments. While the rapid depletion of the Ica aquifer may result in asparagus production relocating to China from where Western consumers can still be fed, Peruvian farmers without irrigation in this desert region will be left with little option but to abandon farming altogether. Meanwhile, Irish agriculture continues to intensify dairy production in the hope of selling more infant formula feed to Chinese parents. Yet Ireland's greenhouse gas emissions per capita are now amongst the highest in the European Union.

These complex interconnections reveal the critical importance of widening our frame of analysis when considering the agro-food system, for it is not only a matter of how and where we are producing food, but what and why we are eating the way we do. Technology-focused innovations preoccupied with raising output not only fail to address the complexity of environmental and socio-economic drivers facing agriculture, they simply do not connect agriculture with the realm of consumption. Yet if we are to devise solutions to rectify the

unsustainable nature of the current agro-food system, we need to begin by challenging prevailing assumptions about consumers' rights to 'cheap' food and the maintenance of current dietary practices that are so wasteful of resources. For example, it is well established that the low price paid by consumers for their food conceals huge externalities along the supply chain (Pretty et al. 2005). Moreover, the continuing upward trajectory in global demand for meat presupposes increased production of intensively reared livestock fed by grains and oil seeds that could otherwise support 4 billion people directly (Carolan 2011). As meat and dairy are the most greenhouse gas intensive foods, the climate change implications are consequently extremely significant.

Conclusions

While agro-food systems are highly complex arrangements, there is growing concern that their interconnected structure and scale - as well as the locus of power that drives them - has left them increasingly vulnerable to a variety of short-term episodic shocks, long-term stresses and lacking the resilience to cope effectively with unexpected events. A growing number of international expert panels have called for a fundamental revision of industrialised agriculture arguing for greater diversification and a move toward agro-ecological farming methods that would work with nature rather than against it (IPES 2016, IAASTD 2009). The challenge, however, should not be regarded simply as a way of maintaining output in a more environmentally-friendly manner; rather it is about addressing production and consumption of food across a complex landscape involving environmental sustainability, social justice and nutritional security. Arguably, eating has the potential to move wealthier societies in a more sustainable direction than many other activities because it entangles every one of us as consumers in webs of relations with producers and connects us to the ecological processes and services that underpin agro-food systems, many of which are under threat (Sage 2012). For these reasons informed citizens have a responsibility to acquire a better understanding of the agro-food systems that feed us and, in turn, make dietary choices that sustain those systems.

Learning Resources

An excellent introduction to the competing interests that shape the food system and the role of public policy to improve human health is provided by:

Lang, T, Heasman, M. 2015. *Food Wars: The global battle for mouths, minds and markets*. 2nd edition. London: Earthscan, Routledge.

The multiple interconnections that tie the agro-food system to the use of environmental resources and the challenges this presents for our food choices in the future is explored in:

Sage, C. 2012. *Environment and Food*. London: Routledge.

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World Health Organization 2016 Obesity and overweight factsheet. Updated June 2016
URL: <http://www.who.int/mediacentre/factsheets/fs311/en/>. [Accessed 20 December 2016]