

Appendix 1. Patterns and Processes of Change in Global Agri-Food Systems

Key Factors	Characteristics	Causes	Consequences
<p>Climate change</p>	<ul style="list-style-type: none"> • Human-induced climate change is leading to significant increases in temperature and alterations in the frequency and distribution of precipitation in different agricultural regions • Equally, the incidence and severity of extreme weather events (e.g. floods, droughts, tropical storms, etc.) appears to be on the rise 	<ul style="list-style-type: none"> • Population size and per capita consumption are the two greatest drivers of climate change • Global population increased 3.7-fold during the 20th century, to 6 billion people, and is forecast to increase to 7.5 billion by the year 2020 and to about 9 billion by 2050 • Increasing energy-intensity of e.g. agriculture, food transport and processing • The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture • Key public institutions have been slow to formulate effective responses to new issues and conditions resulting from global environmental change 	<ul style="list-style-type: none"> • Global environmental change will affect existing temperatures and patterns of precipitation, increasing risk and uncertainty in agriculture • Agriculture nearer the equator – where most poor countries are situated – will be affected most • In warmer or tropical environments, climate change may result in more intense rainfall events between prolonged dry periods, as well as reduced or more variable water resources for irrigation. • Such conditions may promote pests and diseases in crops and livestock, as well as soil erosion and desertification. • Increasing development into marginal lands may in turn put these areas at greater risk of environmental degradation

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<p>Intensification and expansion of modern agriculture</p>	<ul style="list-style-type: none"> • Steady increase in land and water productivity, with average grain yields rising from 1.4 to 2.7 tonnes per hectare during the past four decades and significant gains in water productivity • Current industrial agricultural practices involve deliberately maintaining ecosystems in a highly simplified, disturbed and nutrient-rich state • Humans currently appropriate more than a third of the production of terrestrial ecosystems and about half of usable freshwaters • Global production of energy crops for biofuels is doubling every few years, and 17 countries have so far committed themselves to growing crops like palm oil, maize, sugar cane, soya and jatropha on a large scale 	<ul style="list-style-type: none"> • In addition to its effects on greenhouse gases, agriculture affects ecosystems by the use and release of limiting resources that influence ecosystem functioning (nitrogen, phosphorus, and water), release of pesticides and herbicides, and conversion of natural ecosystems to agriculture • Control of crops and their genetics, of soil fertility via chemical fertilisation and irrigation, and of pests (weeds, insects, and pathogens) via chemical pesticides, herbicides and fungicides – the hallmarks of the green revolution • Modern agriculture has caused a significant simplification and homogenisation of the world's ecosystems • Four once-rare plants (barley, maize, rice and wheat) have become the dominant plants on earth as humans became the dominant animal. Indeed, these four annual grasses now occupy roughly 40 percent of global cropland • The challenges of water scarcity are heightened by the increasing costs of developing new water sources, soil degradation in irrigated areas, groundwater depletion, water pollution, and ecosystem degradation • Rapidly increasing energy prices and concerns about reducing greenhouse gases are driving major investments in energy crops production and processing 	<ul style="list-style-type: none"> • Grain production, mainly from wheat, rice and maize, has increased at a rate greater than human population. This has helped reduce the number of malnourished people even as the earth's human population doubled to nearly 6 billion over the past 40 years • Entire agroecoregions of the world, which once contained a diverse array of plant and animal species, are dominated by virtual monocultures of a single grain crop • Land and water resources are being degraded through erosion, pollution, salination, nutrient depletion and seawater intrusion • Large agricultural surpluses with respect to effective demand (not real need), and hence pressure on affluent consumers to over-consume and dispose of 'surpluses' • Because of its dependence on fossil fuel for energy and for production of fertilizers and agrochemicals, the profitability of modern agriculture is likely to diminish as energy prices increase • The global rush to switch from oil to energy derived from plants could drive deforestation and biodiversity loss, push small farmers off the land and lead to rising food prices and increased poverty unless carefully managed

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Concentration of production	<ul style="list-style-type: none"> • There has been an extension of capital-intensive production relations throughout farming • In the farming sector, the number of small and medium enterprises has diminished markedly (Rural World 2), while the share of total output produced on the largest farm businesses (Rural World 1) has increased significantly • Rapidly rising energy prices are driving major investments in biofuels production and processing by large energy and grain companies 	<ul style="list-style-type: none"> • Protectionist agricultural policies with high-levels of state support that are biased in favour of large-scale, industrialised production • The competitive pressures of the 'technological treadmill' force farmers to cut costs, which often entails taking steps that may be economic in the short-term, but are unsustainable in the long-run • Large investments in biofuels are already signalling the emergence of a new 'bio-economy', pointing to the possibility that larger companies will enter the rural economy, putting the squeeze on farmers by controlling the price paid to producers and owning the rest of the value chain 	<ul style="list-style-type: none"> • The 'cost-price squeeze' of farm incomes and need for self-exploitation to remain on the land has increased, jeopardising the future of family farming • Increasing capital intensity of farm-based production • Declining farm employment and rapid de-peasantisation/rural-urban migration • Bioenergy provides an extraordinary opportunity to address climate change, energy security and rural development, but multinational investments in biofuels production may take the best agricultural lands, which will increase global food prices. This could benefit some farmers but penalise others and also increase the cost of food

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Vertical integration and coordination	<ul style="list-style-type: none"> Increasing concentration of market power in the upstream sectors supplying agriculture with technical inputs and downstream sectors that process, distribute and market the food Retailers act as 'gatekeepers' in the food system, determining terms of trade with producers through contractual arrangements (preferred suppliers, etc.) Public and private standards are introduced in key value chains to control overall quality, reliability of supply and hygiene practices 	<ul style="list-style-type: none"> The stagnation of markets resulting from declining economic fortunes in agriculture prompted rationalisation and concentration upstream Takeovers, mergers, and leveraged buy-outs have reduced the number of input suppliers, processors and retailers and concentrated power in the hands of a few multinational corporations Corporate recognition that profitability comes from capturing value off-farm rather than from returns from direct involvement in agricultural production. Thus, power in the value chain rests with those who control the 'means of coordination', not the 'means of production' Concerns about reducing corporate risk, increasing consumer protection and meeting consumer preferences lead to a focus on standards for food safety, food quality and traceability 	<ul style="list-style-type: none"> Small farmers are now tied to input suppliers and/or retailers through the development of credit links, provision of combined 'packages' of technologies and specialist advisory services, and control of market access Transnationals and retail chains are able to exert increasing influence over day-to-day practicalities of farm-based production The biggest five corporations control three quarters of the global cereals trade, while the biggest three have 80 percent or more of the banana, cocoa and tea trades, on which may smallholders depend Standards improve production and processing practices, but also serve as barriers to entry to key chains for small producers and small and medium enterprises

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<p>Industrialisation and technological change</p>	<ul style="list-style-type: none"> • Technological change has transformed what were once discrete elements of the agricultural production process into industrial activities that have been incorporated into agriculture as inputs • Most of the genetically modified crops currently being grown in developing countries are cash crops, such as Bt cotton, the characteristics of which are controlled by multinational corporations 	<ul style="list-style-type: none"> • Much effort within the increasingly concentrated agricultural supply industries has been spent persuading farmers (and consumers) of the benefits of adopting particular innovations • Green Revolution technologies, including high-yielding seed varieties, fertilisers and pesticides, have been designed to be used as part of a special 'package' and promoted through national extension systems • The application of advances in plant breeding – including tissue culture, marker-aided selection (which uses DNA technology to detect the transmission of a desired gene to a seedling arising from a cross) and genetic engineering – has led to the introduction of transgenic crops 	<ul style="list-style-type: none"> • Industrial activities (such as manufacturing inputs and processing farm produce) make up a steadily increasing proportion of the food production process • In response to the recognition of the importance of seeds in the marketing of new plant biotechnologies and pesticides, large 'life science' corporations have been purchasing smaller seed firms and taking patents on biotechnology material and methods, and even on plant varieties, with a view to controlling the next wave of technological change and intellectual property rights

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<p>Deregulation and economic liberalisation</p>	<ul style="list-style-type: none"> • Economic reforms have sought to encourage the liberalisation of agricultural trade and reduce state subsidies for farm commodity production • There is a profound disjunction between the mobility of finance capital, and the relatively more geographically-rooted embodiments of productive capital in agriculture • Despite pushing for liberalisation of agriculture in the South, most rich countries continue to protect their own farm sectors through an array of protectionist tariffs and trade policies 	<ul style="list-style-type: none"> • The dismantling since 1980 of large parts of state-run regulatory systems set up after 1945 was specifically aimed at increasing the international integration of the world economy, while its success in doing so strengthened the forces in favour of further integration • This was accelerated by the GATT/WTO Uruguay Round, which paved the way for further trade reform and deregulation • Structural adjustment policies of the World Bank and IMF reinforced these liberalisation reforms • A pre-eminent theme of contemporary global agri-food restructuring has been the capture, management and exploitation of so-called 'intangible assets' – brands and other trademarks, patents and corporate know-how – which expedite the transformation of productive capital into mobile financial capital • High levels of farm support continue in countries belonging to the OECD, at the level of USD \$279 billion (EUR €226 billion) per year. 	<ul style="list-style-type: none"> • Structural adjustment and economic liberalisation policies of the 1980s and 1990s saw a withdrawal of the state and the rise of private capital • The Uruguay Round of GATT was most effective in eliminating or reducing direct tariffs and the crudest forms of non-tariff barrier – forms of protection generally employed by the poorest countries with the least sophisticated institutional structures. It was least effective in dealing with the forms of non-tariff protection characteristic of (and arguably only available to) advanced industrialised economies • Farm subsidies in OECD countries depress world prices for several key commodities (especially sugar, cotton, milk, and beef) and deeply undermine agricultural growth in developing countries

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<p>Urbanisation</p>	<ul style="list-style-type: none"> • The world's urban population multiplied ten-fold during the 20th century • Many cities still have significant sections of their economy and employment structure related to forward and backward linkages with agriculture • Cities require a large input of fresh water and other natural resources, and the more populous the city and the richer its inhabitants, the greater the demand on resources and, in general, the larger the area from which these are drawn 	<ul style="list-style-type: none"> • Virtually all the nations that have urbanised most over the last 50 years have had long periods of rapid economic expansion and large shifts in employment patterns from agricultural/pastoral activities to industrial, service and information activities • The internationalisation of world production and trade (including the very rapid expansion in the value of international trade) has been an important part of this, and has influenced urban trends in most countries • Agriculture is often considered as separate from (or even in opposition to) urban development, yet prosperous high value agriculture, combined with prosperous rural populations, has proved an important underpinning to rapid development in many cities • Rural-urban migration is overwhelmingly the result of people moving in response to better economic opportunities in the urban areas and/or to the lack of prospects in their rural communities • The demand from city-based enterprises, households and institutions for the ecological services of watersheds, farmlands, forests, rangelands and aquatic systems grow as their populations increase and become more wealthy 	<ul style="list-style-type: none"> • Most of the world's population growth in population between 2000 and 2020 is expected to be in urban areas • By the start of the 21st century, agriculture generated less than one-quarter of the value-added within the GDP of low-income nations; for middle-income nations, it generated only 10 percent • The tremendous growth of urban areas has spurred a need for a different view of food security, with an emphasis on access and incomes, as increasing numbers of people do not grow their own food, and are quite removed from the production process • Transfers (remittances) of capital, technology and other productive assets from relatives working in urban areas are becoming increasingly important sources of rural livelihood security • Continuing urban growth, without attention to reducing cities' 'ecological footprints', will be a key factor in underpinning increasing concentrations of greenhouse gases in the atmosphere, and thus a key cause of the very serious direct and indirect costs this would bring

Sources: DFID 2005; Fischer, et al. 2002; IPCC 2007; OECD 2005; Pimbert, et al. 2003; Pritchard 2000; Satterthwaite 2005; Smil 2000; Tacoli 2006; Tilman, et al. 2001; Tilman 1999; Thompson 2003; UN-Energy 2007; UN Millennium Project 2005a; Vorley 2003, 2002; World Bank 2007, 2006, 2005, 2002.

