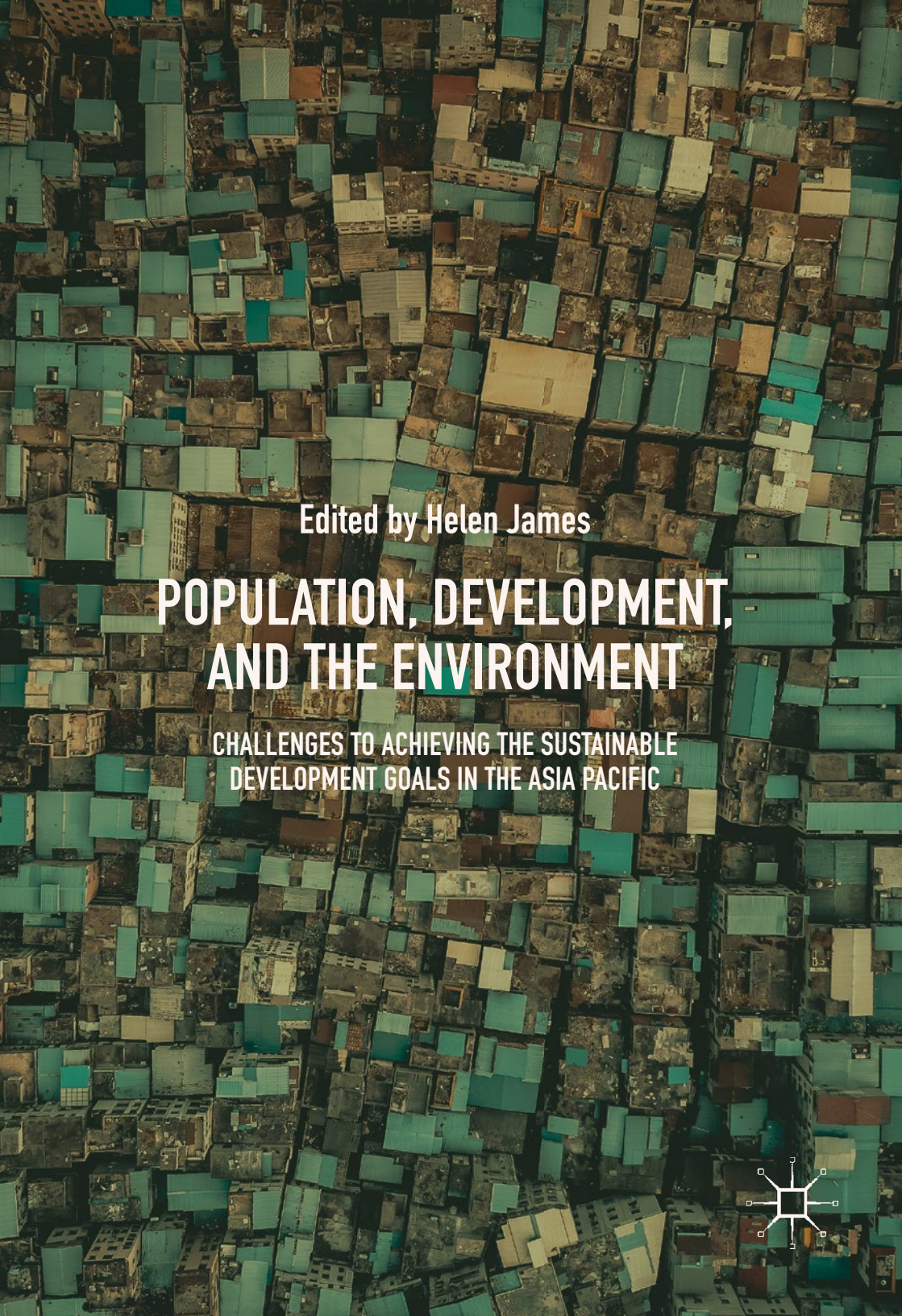

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POPULATION, DEVELOPMENT, AND THE ENVIRONMENT

CHALLENGES TO ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS IN THE ASIA PACIFIC

Population, Development, and the Environment

Helen James
Editor

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CHAPTER 4

Food, Agriculture and Small Farmers in Asia

Lindsay Falvey

Introduction

Within the theme of population, development and the environment from the perspective of the Sustainable Development Goals (SDGs), this chapter considers the nexus with food demand, including that of an increasingly urban consumer base in Asia, where risks are increasing of disease transference from domestic livestock. Beginning with the context of food security and small farmers, the discussion introduces some examples of breakthroughs of recent decades as an indication of what is necessary to meet future food demand. The discussion then considers research and development within the SDGs and seeks to align regional and international agenda to the essential role of producing secure, safe and nutritious food as a priority in development. In considering food production, it is acknowledged that agriculture changes the natural environment to suit human needs, and that sustainable intensification of food production will proceed for the foreseeable future.

Environmental consequences of food production have been misrepresented as something that could have been avoided. While true in some cases, most such arguments rely on current knowledge to critique past actions, while also neglecting the primary objective of past research break-

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H. James (ed.), *Population, Development, and the Environment*,
https://doi.org/10.1007/978-981-13-2101-6_4

throughs, which from the 1960s were overwhelmingly to avert starvation. This chapter is not the place for a detailed discussion of the relative morality of human lives saved against environmental costs; however, the food needed for the world's and, in particular, the Asian region's population relies on constant development and application of new technologies generated from agricultural research. Such research has been part of the delicate balance that maintains the stability of food availability (e.g. Regenerative 2014) essential for governance to begin to be able to oversee useful socio-economic development. Food production particularly attracts criticism of its large monocultures; globally, the major human foodstuff—cereals—relies on both those large farms and small farms that characterize most of the world's agriculture. Within the rapid economic developments of the Asian region, small farmers continue to be the major source of food production. Their role in the region's security is critical, both for their diverse food outputs and self-supporting lifestyles that allow many to remain in rural regions and so not contribute to the complex load of urban poverty.

Although farm size tends to increase in the developed world, it is the essential contribution of the small farms of two–five hectares that characterize the Asian region and much of the developing world has been discussed more fully elsewhere (Falvey 2010) as a parallel necessity to that of large farms. Numbering approximately two billion, small farmers are the majority of Asia's and the world's farmers, and technologies suited to their specific agricultural environments, and thus their production technologies, often differ from those of large corporate enterprises. With both farming types represented in Asia, and with Asia containing half of the world's population and only one of the world's seven or so major net food exporting nations, the rising food demand of populations is one of the clear outcomes of population increases. As Short (2009) observes "international organizations, governments and religious leaders will be the last to appreciate the gravity of the current situation, and the last to implement effective measures to halt further population growth." The apparent slowing of the rate of population increase correlated with affluence ironically does little to mollify the situation, since food demand actually increases with wealth as a result of a further 30 per cent of food being required to cover the inefficiencies of urban food supply systems, including wastage and the wealth-induced dietary changes (Falvey 2010).

This situation has emerged very quickly in Asia with its rapid economic development and increasingly open markets. While food security is seldom

a feature of international news about the region, it has been a preoccupation of the most populace countries of China and India, both of which are historically aware of the underpinning role of wide access to food as an indispensable pillar of governance. This holistic view of development recognizes that ensuring food security is the hallmark of good governance—a lesson from agri-history that is evident from older tribal to modern national levels. In Asia, and indeed outside the rich nations in general, the food producers are mainly small farmers who operate increasingly in commercial value chains, although some continue to sell only the food that is surplus to their subsistence requirements. Rather than view such reliance of small farmers as an exploitative economic arrangement, or as a disappearing cohort of a past era, it is more accurate to see a large segment of small farmers continuing to adapt to new conditions as they always have, which today include value chains that channel their products into urban supermarkets.

Globally more than half of the world's more than seven billion people now live in cities where interrupted food supply quickly results in riots that can disrupt social and economic development. Meeting food supply gave confidence for the current economic developments that resulted from the Green Revolution of the 1960s and 1970s, which was an overwhelming success, albeit with contingent costs. It allowed technologies that had been developed in rich nations to be adapted to suit the production conditions of poorer nations across much of Asia. After major successes, the Nobel Peace Laureate Norman Borlaug (1970) of the Green Revolution pointed out "the tide of the battle against hunger has changed for the better … but ebb tide may soon set in if we become complacent and relax our efforts."

It is easy to forget that the predictions of the time were that a major famine would result in the absence of coordinated application of agricultural science. China repeated the phenomenon by making research for increased food production its primary development policy and turned predictions of major starvation into national self-sufficiency in basic foodstuffs with some capacity for export, again at some environmental cost. China and India today support major agricultural science centres, which are increasingly the underpinning source of regional stability built on food security. Yet globally, the majority of research that stimulates continuous improvement in agricultural yields focuses on broadacre farming, while the needs of the small farms that feed about half of the world are underfunded (Alston et al. 1995). Even for those who adhere to the challenge-

able assumption that farm size will quickly increase following rich nation mores, this could be hazardous since the small farmers are a major source of current food security, especially in Asia. Just to be clear: if small farmers are displaced in large numbers and migrate to cities, the increased food demand for Asia could rise to the most pessimistic predictions of food demand models. Most commonly, the assumptions of rapid increases in average farm size accompany free trade ideologies.

Sole reliance on free trade in food is a risk for any poor net food-importing country (Falvey 2010). This is readily illustrated by the reminder of our inherent nature expressed through national governance in recent experience. We saw India in 2007 and Russia in 2010, each stands accused of subverting international free food trade when they banned most exports of grain in the face of drought-induced domestic shortages. Such actions by grain exporting nations are said by ideologues to induce unnecessarily large global price rises. Yet these governments followed their historical role of first catering for their citizens, not just out of some moral imperative but in order to ensure national stability. As Asia grows ever wealthier, it is easy to assume that free markets will apply to food like all other goods, since this seems to work for the rich industrialized nations. The critical difference remains the huge populations in Asia compared to industrialized nations, which generally have high levels of food self-sufficiency, additional production assets and in some cases are the major food exporters. As I argued elsewhere, food is always different to non-essential commodities—free trade may be applicable to luxury foods but is an unwise policy for net-importers of basic foods with large populations (Falvey 2013). In the case of Southeast Asia, the regional nature of the global rice market provides a ready example of the dangers of relying on free markets, as illustrated in Fig. 4.1 for cereal prices, especially rice—and the incidence of urban riots. Nobel Peace Laureate Amartya Sen's (1982) work has shown that reliance on free markets for a life essential such as food can fail when those with financial resources cause food cropping land to be switched to produce cash crops or non-agricultural products in place of food crops in response to market forces. Examples abound in Sen's and others' work, from the 1840s Irish famine to that in Bengal in 1943. The danger appears to be greater in populous nations.

In discussions that focus on Asia, the world's two most populous nations, China and India, have often provided nightmare scenarios of food and health risks. While risks remain in terms of population pressure, disease transfer and environmental changes, both nations have successfully

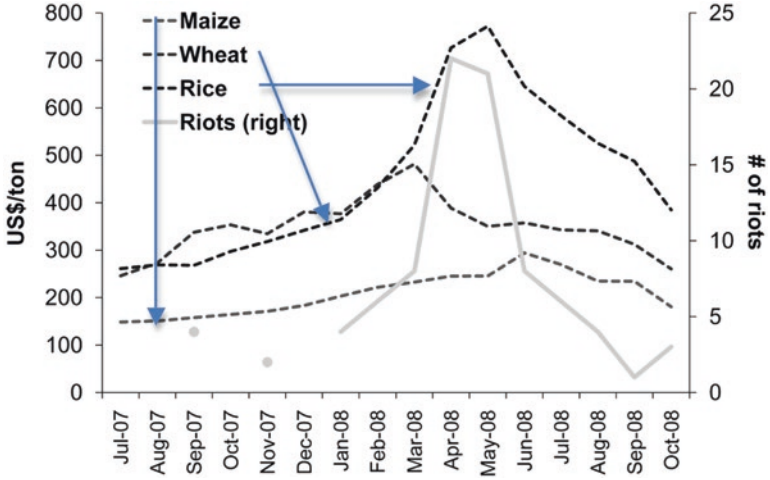

Fig. 4.1 Cereal price spikes and riots 2007–2008. (Source: von Braun 2009)

focused on food production. Their methods include variations on the approaches that Western nations imagine; in all probability, it is China and India that will lead the way for the rest of Asia in terms of innovation and research applications in food production. Both nations continue to rely on small farmers in parallel with large-scale production and to orient technological and market development to both sectors according to their requirements. To emphasize the point, using China as an example of its reducing food insecurity—in feeding around 20 per cent of the global population, China is integrating many of its hundreds of millions of small farmers into the food supply and value chains to serve national consumers that demand diverse sophisticated food products. Importing luxury foods and obtaining the use of foreign farmlands to service additional demand also form part of the wider approach, but for its domestic production new technologies including advanced irrigation, sensors, robotics, information management and genetic manipulation underpin the quest for sustainable intensification of food production. With a more rapidly rising population, India similarly reduced chronic hunger from more than 260 million in 1979–1981 to 230 million in 2003–2005.

These are snapshots of Asia in recent history. The future promises to be even more advanced as China and India become the leaders in the com-

plex biological sciences that make up agriculture. Meanwhile, agricultural research funding in wealthy nations is declining (Alston et al. 1995). The world reached the point of apparent food security by a relatively small yet sustained form of research assistance from wealthy nations to the developing world, and now appears to have at least partially passed the baton to new leaders. To understand the historical context, it is useful to review some examples of the breakthroughs that have resulted from the continuing international research community. International agricultural research involves many national research systems, and international development assistance including loans, but can be represented by a short consideration of the CGIAR, an acronym that once stood for the Consultative Group for International Agricultural Research—a system of 15 international research institutes funded mainly by wealthy nations to service food security and poverty in poorer nations.

Continuous Global Support

The CGIAR laboured against a context that has, until recently, viewed agricultural development as a dragon industrialization and rising standards of living, but is now understood correctly as a driver of economic and social development (de Janvry 2009). Five decades of experience in addressing the critical issue of increased food production has provided the confidence that future food needs can be met from research and development inputs—and lessons from the past can inform increased efficiencies for future research. This was the approach taken by the International Food Policy Research Institute (IFPRI) (Spielman and Pandya-Lorch 2009) in identifying past successes, which varied from improved crop varieties, cultivation practices, reduced pests and diseases losses, managed drought scenarios, efficient water management, focused policies and regulation, as well as orienting production to market needs. The resulting analysis and its examples are summarily grouped for discussion into intensification, environmental sustainability and market reform.

Intensification

From about 1950, India prioritized rural roads and electricity, irrigation, state agricultural universities and research institutes, fertilizer plants and land reform, and welcomed international agricultural research efforts. One result was an ability to control the historic negative yield impact of

fungal wheat rust. By such focused research, it is estimated that about 117 million hectares of wheat were protected that secured the food of 60 to 120 million rural households and millions of urban consumers (Evenson et al. 2006). This success involved the international collaboration that began the Green Revolution, the basis of the CGIAR, which went on to make further breakthroughs. Improved rice and wheat varieties suited to double cropping under irrigation followed and supported other crops, benefitting more than one billion people through increased access to food and income. Another way of expressing this is the survival of some 30 million children who would otherwise have died, nearly 70 per cent of whom were in Asia (Evenson et al. 2006).

Environmental Sustainability

Overuse of pesticides and fertilizers, profligate irrigation and soil loss from cultivation were by-products of food production successes, and these were then addressed by broad-based education, policy development and new technologies, such as zero tillage, in India, Nepal, Pakistan and Bangladesh where it was adopted by more than 600,000 wheat farmers leading to substantial environmental and financial benefit. Rather than view environmental effects in isolation and as failures, it is responsible to consider them in comparison with their benefits. Weighing and addressing the negative impacts of technological change is a constant responsibility of agricultural research, like all applied research.

Reforming Markets

Liberating seed and fertilizer markets and commodity prices from government controls stimulated new innovations from the commercial sector that further enhanced food production policy reform in China, and allowed a private seed industry for hybrid rice to develop that spread across more than 60 per cent of its rice lands (Li and Yuan 2009). Similarly, India allowed private investment in seeds, which in conjunction with research led to yield increases of more than 80 per cent (Pray and Nagarajan 2009). Success factors were generalized as diversification, policy reform and food quality.

Asia benefitted widely from diversification away from reliance only on staple cereal crops to the inclusion of livestock products and legumes, thereby improving nutrition and incomes of millions of farmers

(Shanmugasundaram et al. 2009). India's Operation Flood stimulated the creation of small-scale dairying and processor cooperatives that, along with policy reform led to India exporting dairy products (Cunningham 2009). A similar development occurred with Tilapia fish production in the Philippines (Yosef 2009).

Policies that favoured urban populations and inadvertently disadvantaged rural dwellers including farmers were reversed in China by liberating small farmers from decades of enforced collective farming (Lipton 1977). The policy reform of the Household Responsibility System covered more than 90 per cent of the farmland and provided an estimated 160 million farming families with incentives that led to their incomes doubling, rural poverty decreasing, grain output increasing by more than 30 per cent, and the freeing of some labour then needed for industrial development (Kirk 2009). Vietnam followed a similar path in policy reform changing it from a food-importing nation to become one of the world's largest rice exporters (Kirk 2009). Security of land tenure has been key to such reforms that encourage private initiative and the development and use of new technologies.

With technological, diversification and policy reform successes, the quality of food soon became a focus. Where once discussions about food security focused on energy intake, now micronutrients are seen as also being central and this can complicate agricultural development even further (Berti 2004). From home production of vegetables to urban livestock production, nutrition is seen as the sustainable means of countering the compromised mental and physical capacities that result from micronutrient deficiencies. Some successes have been quantified, such as in Bangladesh (Iannotti 2009). In Vietnam, simple improvements in local systems of fresh meat marketing have reduced contamination risks, while avoiding the costly developments that might otherwise have been required, if rich country approaches to food safety had been immediately mandated (Grace 2015).

Building on Success

Successful developments, such as those outlined above, have been the result of integrated understanding rather than single-focus interventions. They have occurred at their own pace, some relatively rapidly, while others have taken decades. Common elements of success can be elicited and include the following:

- Sustained investment and global collaboration in agricultural research
- Complementary integrated development investments
- Appropriate policies that stimulate whole-of-economy private investment
- Including communities in planning, innovation and implementation

To build on this knowledge for food as a globalized commodity in terms of markets, trade and preferences, strategic planning by governments is required backed by informed regulation that supports delivery of the primary governance role. This is a continuous process, adapting to ever-changing environmental and market conditions in the pursuit of outputs in a longer time frame than can often be foreseen. Outputs of individual research projects, conceived and interpreted in terms of their inter-relationships with other factors, are the major actions of this continuity and are most applicable when development planners have a broad understanding of science and philosophy in addition to economics, for, as Alfred North Whitehead observed "no fact is merely itself" (1938). It is this element of complexity that has, in the past, been overlooked by single-element developments that omit consideration of integrated systems, concentrating, for example, on yield increases without understanding environmental costs, infrastructure constraints, socio-cultural beliefs or market conditions. Single-focus approaches, such as increasing cereal production without considering other inter-relationships can counterintuitively undermine food security, if they detract from systemic understanding. Integrating diverse disciplines across the biological and social sciences has been the essence of agriculture science, and it is from that great legacy that Asia has been able to reach its current ascendancy; yet challenges remain.

Challenges

The future for food and agriculture has been summarized by FAO (2017) in the integrated terms of the SDGs. For example, FAO predicts the need for a 50 per cent increase in food supply by 2030 to meet population demand for rising population and wealth-induced growth in the consumption of meat, fruits and vegetables relative to cereals, with the most rapid changes occurring in Asia. Yet, at the same time, the rate of yield increases has slowed, probably in relation to such factors as rich country

de-prioritization of agricultural research and reduction of the natural resource base arising from urban expansion into farmlands, soil erosion and climate change (Alston et al. 1995). Such pressures appear to be greater in less food-secure regions, which in the short term will lead to threats to crop, livestock and fish production and then possibly stimulate further agricultural incursions into forested and marginal lands. Added to such factors is the rising incidence of disasters impacting food production from floods, droughts and conflict. While recognizing the major strides in both poverty reduction and general food security, dietary deficiencies that lead to stunting, incomplete mental development, blindness and other complications for some two billion people globally hamper the economic development that was once assumed to automatically flow after satisfying general dietary energy needs. The effects of micronutrient deficiencies are insipid, often delayed and perhaps less "breaking-newsworthy" than the starvation resulting from absolute deficiencies in energy intake; yet the limitations they impose on development are significant. New genetic technologies allow the inclusion of micronutrients in available foodstuffs, yet still face some ideological barriers from influential nations. Technological development integrated with other components of the wider environment has been and remains key to Asia's continued success in food production. Many new technologies tend to favour capital-intensive agricultural practices that can concentrate ownership of food supply chains in fewer hands and alienate capital-poor small farmers who then migrate seeking urban work, leading to depopulation of males in rural areas. Such outcomes are socially unsustainable and probably represent a transitional phase; in any case, the inequity is not sustainable. Consideration of food, population and the environment in Asia must acknowledge the role of its large agribusiness groups in efficient food production and the role of government in appropriate regulation. Reliance on markets alone for food safety and equity is not a reliable basis for the social stability needed for continued development.

Thus, the challenge for Asia remains. An unspoken assumption that a rising industrial economy indicates food security may have some basis in wealthy Western nations which have long developed the lands best suited to the food production systems that benefit from known technologies. However, Asia represents quite different natural and social environments for which additional technological innovations are needed. Experience has also shown that wealth alone is insufficient; it did not secure the foods of choice for Middle Eastern nations as recently as the 2007–2008 grain crisis, and their subsequent procurement actions were a force in driving

prices out of the reach of some other importing regions. In applying or developing technologies for new environments, Asia's challenges include maintaining production from intensive farming that is implicated in undesirable deforestation, changed water availabilities, soil depletion and other environmental imposts. Various concerned parties have used these observations to decry the loss of traditional Asian production systems, but it is both unfair and unrealistic to suggest that some farmers be kept as museums of past lifestyles. The practical approach is to be open to learning from the enduring values distilled from centuries of experience embedded in such traditions; this is the function of the Agri-history Foundation, an organization that looks at such practices from a largely objective perspective, and which commonly arrives at the need for a wider integrated view of all aspects of an environment. An integrated understanding, one that recognizes the inter-relationships of everything (Falvey 2016), is also emerging in agroecological approaches such as conservation agriculture, and incidentally informs development actions relevant to those who remain vulnerable to slipping back into poverty, as can occur when inequalities are reinforced by otherwise successful developments. Pro-poor approaches for agriculture within an integrated understanding therefore must consider urban and rural areas, not just farmlands. This implies crisis resilience, social welfare and equality in health and education. Part of this is wise policy making, but another part is maintaining an overall awareness of the effects of all investments and the continuing need for smallholder food production and their livelihoods. An integrated approach might be readily appreciated within an agroecological region, including those that cross national borders. It also extends further to the recognition that, as FAO (2017) acknowledges, "All countries are interdependent." This is the realization that allows us to transcend the old rhetoric of "developed" and "developing" countries. The naivety of assuming that national laws or borders keep us independent of the problems of food, population, environment or infections in other parts of the world is now being dispelled by migration and epidemics induced by conflict and climate change. Such inter-relationships underpin the SDGs.

The Sustainable Development Goals

The evolution from the Millennium Development Goals (MDGs) to the SDGs in 2015 has spurred calls for national programmes to align with the SDGs (Schwoob 2016). While this seems appropriate in terms of national

governance, overriding assumptions of the SDGs themselves require action by all nations since all development actions have effects beyond their immediate sphere. In this way the SDGs can be comprehended as a recognition of the integrated nature of all things, or "interlinkages" (ICS 2017). When the subject is food and health, such inter-relationships are now daily brought home to the world through hunger-induced strife and migration, and the fears of zoonotic pandemics.

The coordinated international agricultural research that is a hallmark of civilization in our era involves researchers in wealthy nations, such as Brazil, China and India, as well as most other responsible nations that can afford the costs. Today three factors threaten this essential driver of stability and wealth: increased concentration of ownership of commoditized technologies, decreases in rich nations' investment in agricultural research and the modest budgets of international research institutes. The first is beyond this chapter, the second has been mentioned already and the last of these is of particular importance because it is the means by which value is added to small farmers from research conducted by national governments and private bodies. The principal vehicle for this is the CGIAR system.

The CGIAR works through a strategy that is directly related to the SDGs of no poverty or hunger, good health and well-being, gender equality, clean water, sanitation and climate action, while also contributing to other goals. In particular, its actions can be grouped into three areas: reducing poverty, improving food and nutrition security, and improving natural resources and ecosystems, across which climate change, gender, policies and capacity development are integrated (CGIAR 2016). The 15 CGIAR centres, each governed independently for their specific mandates, cooperate and coordinate with global research bodies to focus on the issues of the poorer nations. Such a focus has produced the amazing breakthroughs described earlier in this chapter, and many others such that calculations of rates of return for the investment costs commonly exceed those possible in other sectors (Lindner et al. 2013). But research outcomes alone do not generate such returns. It is their application in appropriate ways and this necessarily involves government, development agencies and a range of non-government organizations, including in particular the private sector, for agricultural and market infrastructure among other necessities. It is this integrated agricultural service of CGIAR in conjunction with government and the private and other non-government sectors that can underpin the stability of food and nutritional security

across even the marginalized regions of Asia, and so provide the foundation for wider social programmes.

Of particular importance to Asia with a rapidly expanding middle class demanding more livestock products are the production opportunities and income sources that arise for some in rural areas. Livestock is even more important among the marginalized in a society whose diet is at risk of being imbalanced nutritionally. While it is sometimes argued that it is possible to obtain all requisite nutrients from a fully vegetarian diet, in practice it is extremely difficult to do so, unless one is wealthy and enjoys a privileged lifestyle, usually in a Western country. And for the poor, including those in Asian cities, daily or regular intakes of small amounts of animal products have been made possible for many through research and development that makes meat, milk and egg production sustainable and reliable. Ensuring such balanced micronutrient intake for poorer people allows them to participate more fully in their societies, which is a basic objective of development.

With rising wealth, the value of agricultural production in Asia is increasingly considered in monetary terms rather than energy from calories or tons of grain. From this perspective, it is noteworthy that five of the six most valuable agricultural commodities in the world are animal products (FAOSTAT 2015). Figure 4.2 illustrates that the net value of production of cow milk now exceeds that of all other major food commodities, having overtaken rice in recent years. After milk and rice, meat from pigs, cattle, chicken and fish follow and all exceed the values of wheat, soybean and maize. Within the essential animal food sources, wild and farmed fish are often underappreciated, even though they provide more than 20 per cent of the animal protein for Asia. Focusing on means of meeting the needs of the marginalized groups in society, the International Livestock Research Institute (ILRI) and World Fish—both parts of the CGIAR system—develop practices to improve people's lives through livestock and fish production. The ILRI provides compelling scientific evidence for decision-makers to plan for socio-economic, health and environmental dividends while increasing the capacities of farmers and governments to beneficially invest in outcomes from livestock and fish science.

Concentrating on sustainable livestock production for ILRI is much broader than simply increasing yields although it remains central for forage, genetics and health. It also includes ensuring that policies for development are logical, that the interactions between livestock and their

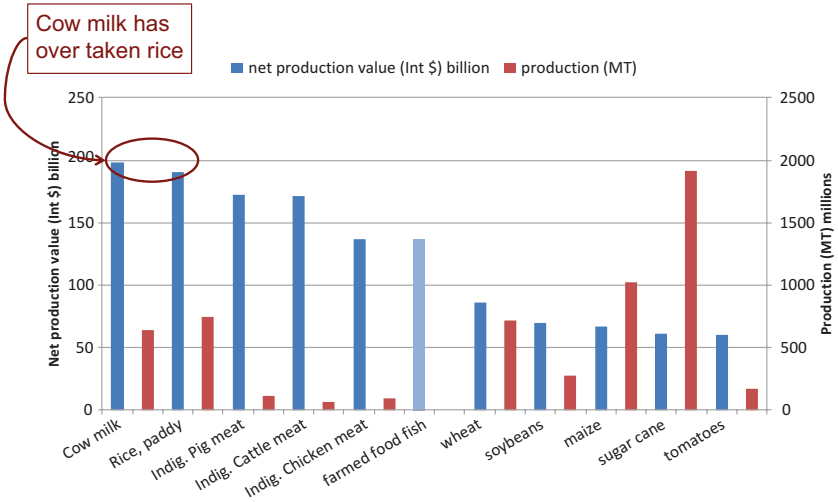

Fig. 4.2 Major agricultural production values and production, 2015. (Source: Smith 2017)

environment are managed and that foodstuffs are safe and healthy. Furthermore, it addresses containment of zoonotic diseases—those that pass from animals to humans such as Avian and Swine influenzas—through the development of new vaccines and diagnostic products. This "One-Health" approach that addresses human and animal outcomes is one of livestock research's examples of an integrated understanding of its mandate. Such research conducted on behalf of the segments of society that are often neglected by economic development aims to integrate them into both the production and consumption of livestock products, which is most logically done by transforming the small livestock systems that dominate Asia's domestic production. The alternatives to this are either importing meat products to service all of the rising demand or importing industrial livestock production systems and knowledge. Both of these can occur without government assistance, and neither obviously assists the marginalized segments of society. The ILRI focus on small producers is neither sentimental nor ideological. It is pragmatic since it is smallholders that produce most livestock outputs, and incidentally half of the crop outputs; they do so competitively without detracting from the viability of large commercial systems. With the large and increasing livestock popula-

tions of Asia in the midst of large human populations, zoonotic outbreaks are increasingly common, as emphasized by Nobel Laureate and ILRI Patron Peter Doherty's statements about specific human disease outbreaks originating from animals (Doherty 2017). The hot spots of such diseases have traditionally been the USA and Europe, which are now being joined by Asia, in particular, North, South and Southeast Asia. These examples link SDGs across health, food sufficiency and environmental considerations.

Conclusion

Progress towards the SDGs can be assessed by indicators subdivided to practical levels, if the integrated nature of the SDGs is recalled, as is currently being done (IAEG-SDGs 2017). Such indicators will assist investment planning, which inevitably will work within the implications related to food that are relevant to population, development and the environment discussed herein. Food and nutritional security remain primary responsibilities of government. Where this is forgotten, environmental degradation proceeds apace and is accelerated by population increase such that development investments become ineffective. Worthwhile ventures for conservation and environmental regulation, disaster recovery, urban reliance, gender equity and the other noble developments discussed in this book depend on the food and nutritional security that have been introduced in this chapter, and which are amplified elsewhere (Falvey 2013).

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