

Some thoughts about the future of food and agriculture

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The fact is simple: 842 million people are currently hungry. These people are some of about 2 billion who lack, at least at times, essential nutrients even if they consume enough calories. A century ago, more than half of humankind was severely malnourished in terms of calories and proteins; today this number is only 1 in 8 – much lower than in the past, but still unacceptably high. In the last two decades, more people than ever before – 1 billion – have been lifted out of poverty and hunger. About 75% of this spectacular global reduction occurred in China. Making similar progress in the next decades means tackling Africa and India.

Hunger and poverty mutually reinforce one another. Undernourished women tend to give birth to underweight babies who are prone to stunted growth, cognitive impairment and disease. Poor and hungry people are often marginalised because they lack the initiative or the means to participate in society. Of the people living in extreme poverty, that is, on less than USD1.25 a day, the majority are women and children.

There are three types of situations in which chronic hunger is experienced. In areas of civil unrest and failing governments, people lack the basic means of survival (this situation may also occur temporarily after natural disasters). In rural areas, where most of the poor and hungry live, there are few employment opportunities and partial food self-sufficiency is eroding. In urban areas the cost of living can be prohibitive, and employment can be intermittent, poorly paid and dangerous. The balance of poverty and hunger is shifting towards urban areas, where soon the majority of the poor will live.

Reducing hunger requires several responses. Emergency food aid is needed to alleviate the needs of displaced populations, coupled with peace. Proper child nutrition is needed to prevent damage from undernutrition. Overall, hunger reduction results from increased purchasing power which in turn comes about through economic growth. More equitable growth leads to a more consistent reduction of hunger. In countries in which a large proportion of the population still finds employment in the rural areas, investment in agricultural production and processing is the most efficient way to reduce poverty. Increasing food supply lowers prices while trade helps to overcome seasonal and local shortages.

Overconsumption and inadequate nutrition touch about 1.5 billion people worldwide who are overweight or obese, increasingly so in emerging economies (Mexico has the highest percentage of overweight citizens). There is an inverse relationship between economic class (income) and overconsumption of calories, although this relationship is less linear in the case of hunger. Overconsumption is associated with undernutrition, as both obesity and malnourishment imply nutritional imbalances. Furthermore, children born from undernourished mothers may risk becoming overweight in adolescence.

The world will need 50% more calories in 2030. The world's population is expected to increase by 0.7% annually. Nearly all that growth will take place in developing and emerging markets, most of it in Africa. Increasing urbanisation and income levels are well known to lead to higher demands for animal foods and a greater dietary diversity, including a reliance on fast food. At the same time, 2.7 billion people will then use traditional biomass for cooking: two thirds of sub-Saharan Africa.

Future demand will be influenced by changes in consumer preferences. Middle-class consumers who increasingly consider food as a way to establish identity and health are driving the changes. Africa now numbers 200 million people with middle-class incomes. Combined with rapid ageing of the population, this growing middle-class sector implies new food products and individualised nutrition. Consumer concern has led to increased demands for transparency and regulation for sustainable, animal-friendly and healthy products. Urban populations tend to eat out more and to eat more pre-processed products. These types of consumer demands – and not supply – will be the primary drivers of change in future agricultural production.

Progress in food production in the past half century has resulted from a successful combination of genetic improvements, such as high-yielding varieties, and improved cropping techniques, in particular irrigation and fertilisers. This progress started in Asia with cereals (known as the Green Revolution) and extended to other crops in Asia, such as cassava, potato, sorghum and some livestock species, and to Africa, and evolved to improved soil and water quality and use of organic fertilisers. Today the approach to improving productivity includes optimal resource use efficiency, including energy efficiency, and reducing greenhouse gas emissions along the entire food chain. Other considerations include meeting goals for human health and the environment, including reducing pathogens and improving the uptake and retrieval of nutrients by humans. The next step enhances nutrition through improved food quality and fortification of essential minerals and vitamins, either bred in the plant or animal, or added during processing.

Thanks to decades of agronomic research, we understand that production resources such as water are used more efficiently at higher resource endowment, i.e. when fertilisation or crop protection are optimal. This principle also appears to hold true for animal production. The potential to increase resource efficiency is matched by the availability of underutilised lands. The successful exploitation of Brazil's *cerrado* (savannah) region, hitherto considered marginal land, has led to a reassessment of land resources. Sub-Saharan Africa has ample underutilised land, together with surface water resources, which may allow considerable expansion of irrigated areas (now at 4% as opposed to 40% in Asia).

Food security requires provisions to reduce vulnerability through (regional or local) stocks and economic incentives, e.g. crop and animal insurance. In flood-prone areas, flood risk prevention should be coupled with

disaster management including safe areas for people, cattle and stocks. Furthermore, farmers are usually unable to use new technology if they have no secure land title and no access to secure financial and credit services or to marketing and other inputs such as irrigation and fertilisers. Above all, food security requires an enhanced emphasis on food safety in complex and anonymous food chains in which vertical upstream integration leads to increasing concentration of power. Retailers want to ensure supply through contracts and the acquisition of food processors. This dominance, driven by cost-cutting, leads to anonymity of suppliers and has replaced the long-term contracts that existed previously, which often were based on trust. Concentration means that a small group of players determine a large part of the market, resulting in lower prices for producers and potential irresponsible behaviour. The current lack of a level playing field in terms of public health, animal welfare and greenhouse gas emissions may put consumers at risk. The best way to create a level playing field is through international agreements, open borders and trade, and capacity building to bring all countries up to the same standards.

Overall, our food is safer than ever, but structural weaknesses exist, resulting from inadequate regulation, sloppy compliance and even fraud, as well as public health risks posed by high concentrations of animals, in particular pigs and poultry, close to major urban centres. Physical segregation of animals needs to be enforced, as well as protection of workers. Efficiencies in feed supply are to be addressed, in particular the improvement of nutrient uptake through digestion. Antibiotics must be strictly regulated. More can be done to reduce greenhouse gas emissions from livestock, even if trade-offs exist among animal welfare, public health and the environment.

The most pressing food security issue today is the provision of animal proteins. Since 1950, global livestock has grown fivefold and the demand for animal protein is expected to increase by 75% in 2030. No other issue raises more moral, political and technical questions and leads to greater lack of consumer confidence. Alternative protein sources, from plants, algae, insects or even bacteria may reduce the demand for food and feed. It is possible to substitute up to one-third of animal proteins in processed meat. The use of alternative resources, including the retrieval of proteins from waste and insects for feed or food, makes perfect ecological sense. Consumers need to be enticed to make the right – i.e. healthy and sustainable – dietary choices through education and diversification, in particular with respect to proteins, fruits and vegetables.

Labour requirements in developed economies have dropped dramatically in the last century, to 5% of 1900 levels in wheat production, whilst yields grew fivefold. However, in most countries, rural labour availability is declining rapidly because of migration and rising urban wages, while mechanisation remains underdeveloped. As a result, food production becomes increasingly the job of female farmers, under harsh conditions, leading to low labour productivity. Furthermore, the agricultural labour force is aging rapidly. One of the most urgent issues is to entice young and dynamic men and women into agriculture by providing them with the means to become entrepreneurs who earn a decent income and to dispose of labour-enhancing technology. The 500 million or more smallholder farmers of today should not become victims of low capital, a small labour force and low land productivity. Appropriate technology, based on the latest scientific insights, is required. Smallholders do not want to remain small if it means low income and low status. Adolescents and the youth number 1.8 billion today. If we assume that the current smallholders will consolidate and modernise their farms, leading to a reduction by, say 20–25% until 2030, we will need 350–400 million youngsters, nearly one in five, to go into farming and food production.

Climate change may influence plant and animal growth through CO₂ levels, day and night temperatures, precipitation, lengths and dates of onset of growing seasons, rainfall variability, wind speed, pest and disease build up, sea level rise, groundwater tables and salt intrusions. Insect-borne diseases may become an important problem. In regions affected in the relatively short term by reduced precipitation, i.e. Africa,

Australia, the Mediterranean and the Middle East, yields are projected to decline as a result of water and heat stress. Many of the challenges of climate change may be met by age-old techniques dealing with the vagaries of weather. However, the speed of change is new, as are the number of people affected. It seems likely that climate change will lead to more fluctuations in production in response to weather variability and possibly increased probabilities of extreme weather events. Global net land-use effects, in terms of area needed for future agricultural needs, seem limited, but local area expansion is expected because of unfavourable weather conditions.

Food is not oil – it is a renewable resource that cannot be exhausted, as food production renews itself with every growing season through photosynthesis. With the possible exception, on a scale of hundreds of years, of phosphate, the inputs for food production (solar radiation, water, nitrogen and potassium) are not globally deficient, even if there may be local shortages. Food is grown by farmers who do not act like a cartel. But food is like oil in the sense that as a set of commodities it is up for speculation. On futures markets, a dry summer in the main producing countries drives up the prices. Prices are likely to rise against the historical low of food prices around 2000 and the long-term downward trend preceding it. Structural and conjectural factors explain the current fluctuations. The extremely rapid growth in demand for food grains, feed and animal and fish products in places like China, India, Brazil and Central Europe has surpassed the growth in production. Production is relatively inelastic and cannot adjust quickly to higher prices, which has led to declining stocks. Increasing energy prices have also affected agriculture through land preparation, transportation and processing costs. Concern about price volatility in recent years has led to suggestions about the creation of global cereal stocks. However, maintaining these stocks is costly and may lead to price distortions. Open trade and transparent markets seem the best guarantee. Overall, rising food prices facilitate investment in agriculture, even though they may be disadvantageous to the urban poor and poor food importing countries.

More than before, public opinion is a driving force in the future of food. The lack of communication by scientists, the private sector and governments has led to severe misconceptions, a lack of trust, false dichotomies and resistance against technology. At best, public opinion alternates between genuine concerns about safety and food nostalgia. The education of the consumer on the realities of food production is important to promote a realistic debate about options.

Lastly, food security is the responsibility of the state. This does not mean that food security necessarily requires state intervention. A strong positive relationship exists between food security and safety and democracy. The state has a role in creating the conditions for sustainable food systems, through a combination of fiscal, legal and policy measures. Markets operate within this framework, and only where markets fail, governments must intervene. Complex and intertwined markets now extend all over the globe and have helped to avoid local food shortage and promote income growth in many hitherto isolated areas. However, such chains require international monitoring.

Never before in human history has the responsibility for the food of so many been borne by such a small minority of farmers, food processors and retailers. A minority that is barely recognised, and often blamed for the ills of environmental damage. The world in which we live is not predictable, but growth is essential to meet the needs of a growing world population with growing aspirations. We know better now than before how to mitigate the negative effects of such growth. The clear trends of the last decades in terms of food production and food security allow us to believe food security and safety for all can be reached in a sustainable manner.

In many ways, South Africa embodies both the challenges and the potential of African food production and consumption. Moreover, through its science and technology and, hopefully, through its enlightened policies, rural programmes and excellent academic institutions, South Africa could play an important role in Africa. The challenge is for South Africa and Africa to live up to the pledges of Maputo and to reverse the declining investment in food and agriculture.

