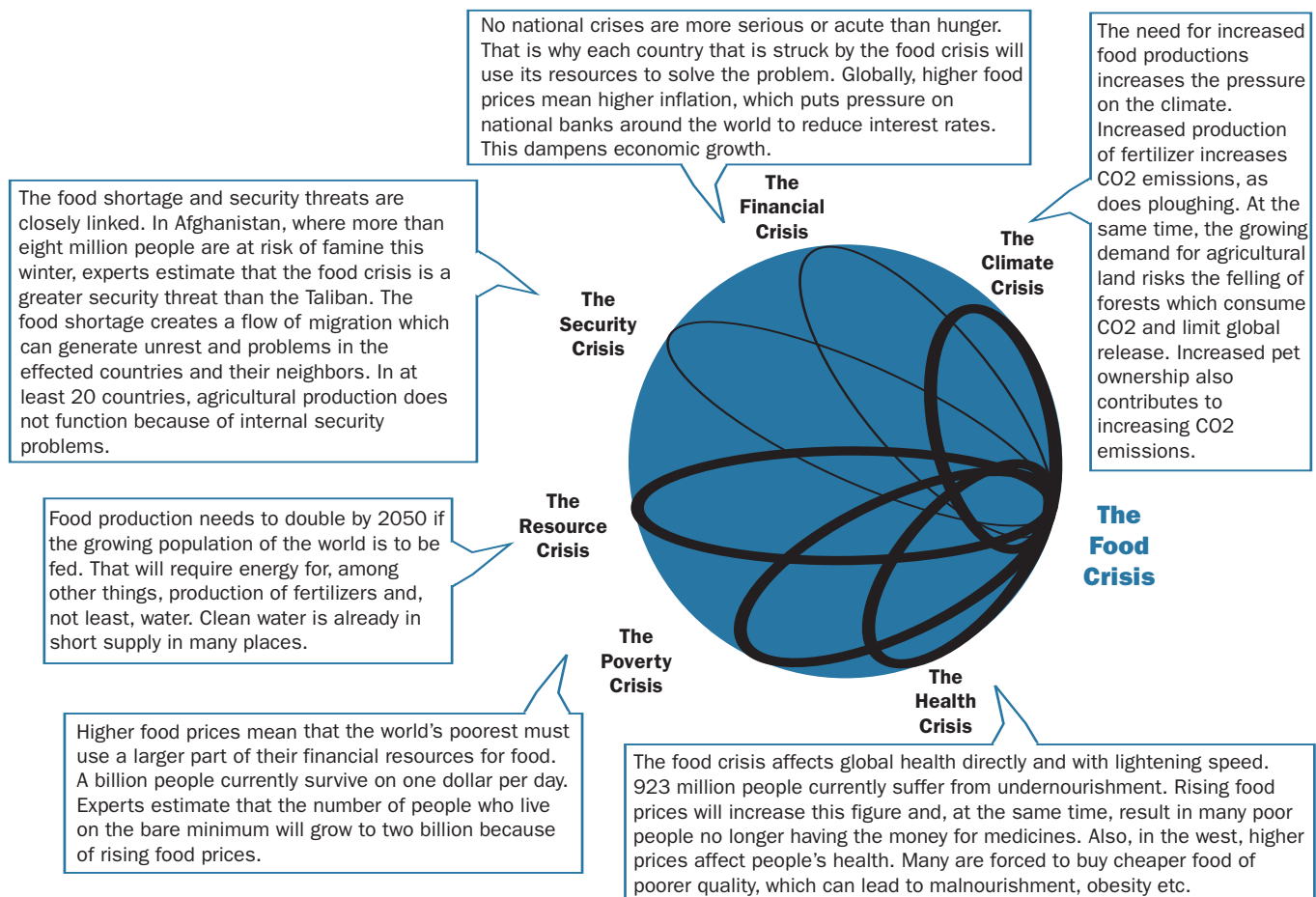


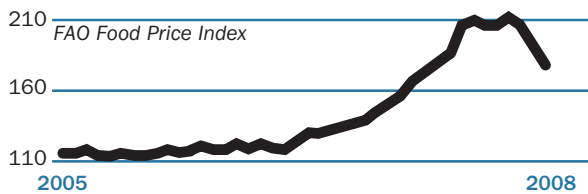
4 The Next Agricultural Revolution

The world is balanced on the brink of a food crisis. 923 million people are undernourished and 36 nations have a real problem supplying food to their populations because of unstable weather patterns or internal conflicts. Overall, the world produces just about the quantity of food it needs, but because of the fast growing global population, a doubling of production will be required before 2050 if we are to prevent millions from going hungry. The food crisis is acute, but can be resolved with solutions that can ease the immediate needs and function in the long term. Right now there is a need for considerable development of farm land in, among others, Africa and Russia. In the longer term there is a need for a leap in efficiency, from new, high yield plant types; intelligent fertilization; and water distribution that will increase profits. It will be vital to secure a well functioning market – both nationally and globally. The instability of market access is currently the biggest obstacle to investing in, for example, an expansion of farmland in Africa. An agricultural revolution in Africa could not just help ease the food supply problem, but give the entire continent a significant growth boost.

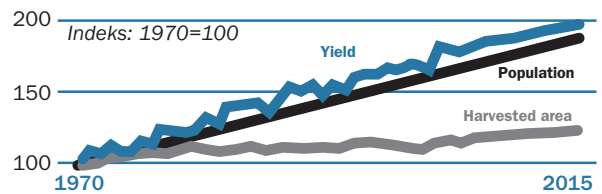


MM | The world is at risk of a new large increase in food prices

Development in price on food



Development in production of grain and oil seeds



Source: FAO and US Department of Agriculture.

THE NEXT AGRICULTURAL REVOLUTION

The increasing price of food in 2008 was not just an irritation for western consumers. Since the summer of 2007, it has prompted protests, strikes and even revolts in more than 50 countries around the world. Price rises are catastrophic for the world's poor. The billion people who survive on less than one dollar a day have suddenly lost half of their purchasing power. Following price rises, as many as two billion no longer have the means to supply themselves with sufficiently nourishing meals. 932 million people are undernourished today. The risk is that that figure will increase by a further 130 million over a short time.

According to the latest edition of the FAO's "Food Outlook", the financial crisis and the tightening of credit conditions have already forced farmers to plant fewer crops than last year.

This gives little optimism for the immediate future. Even though current harvest predictions are reasonable, combined global corn production is expected to increase this year by 4.9 per cent, and prices in the food sector have fallen in recent months, the food crisis is nowhere near over. The market is expected to remain turbulent for the next 5-10 years.

A range of factors, both in terms of their individual impact and their more widespread combined impact, mean that food shortages could be a permanently recurring phenomenon in the coming decades, and drive more hundreds of millions of people to hunger and need:

- **MORE MOUTHS TO FEED.** The world's population is growing by 78 million a year. To feed them all would require a doubling of food production by 2050.
- **CLIMATE CHANGE.** Extreme weather patterns create even greater problems for agricultural production in a number of countries. Currently, 16 countries are affected by hunger in part or all of their territory because of poor harvests due to weather changes that can be attributed to climate change. Some countries experience drought, others floods and hurricanes. Water shortages could become one of the world's greatest problems.
- **POOR MARKET ACCESS.** Many farmers could and want to increase production if they could be sure of being able to sell it for a reasonable price and profit. Many hold back from increasing production because they do not have access to a func-

tioning market for their produce. Some countries lack the infrastructure to enable the transportation of produce to places where there are shortages. And there are also significant difficulties in terms of the global market. Many countries protect their own farmers from competition from other countries, and restrict their exports when demand is great.

- **LACK OF FINANCE.** There is no global lack of agricultural land, but there are instead major problems in finding the finance necessary to establish new agricultural production. Many banks consider investing in farming to be high risk – particularly in Africa. One of the reasons is that the market for agricultural produce doesn't function properly, which means that there is no certainty that the products can be sold.
- **SECURITY THREATS.** Agricultural production is too low in a number of the world's poorest countries because it is hampered by armed conflict, riots and internal unrest. 20 countries – most of them in Africa – are in a situation in which a proportion of their population is at risk of famine because of internal security issues.
- **BIO-FUELS.** Experts estimate that production of corn and wheat for use in producing bio-fuels was responsible for 30 per cent of global food price increases in 2007 and 2008. If the USA and Europe uphold targets to increase the use of bio-fuels, it will continue to increase demand on agricultural production in the future.

The Art of the Possible

Food shortages are, self evidently, a catastrophe. The solution to avoiding catastrophe is simple: global agricultural production must increase by 2 per cent per year.

A quick overview of the world's resources shows that the starting point is good. But such a production increase does not happen by itself. It requires effort in a range of areas:

- **TECHNOLOGY.** When the world's food stores grew so large in the 1980s, it brought an end to most agricultural research. There was already a large surplus of food and limited interest in increasing yields any further. That is why today the agricultural industry badly needs a major innovation drive. There

NEW GROWTH OPPORTUNITIES

Highly productive crop types: 80 per cent of the growth in agricultural production is expected to come from increased yield from agricultural land. This requires new seeds, types of corn and crops which give considerably higher yields than currently. Genetic modification of plants is expected to be central to development.

GMOs: It is possible to develop foods which have special health benefits. One of the most widely known examples is the so-called “golden rice” – a type of rice which contains beta-carotene which increases levels of Vitamin-A. Vitamin-A deficiency is responsible for hundreds of thousands of people losing their sight – or lives – each year. Golden rice and similar products are not yet available on store shelves due to ethical concerns. But they could be a growth area as the demand for food gradually grows.

Desalination: The global market for water already surpasses 500 billion dollars and is expected to grow to more than 650 billion dollars by 2010. Up until now, attempts to make salt water drinkable have been expensive, ineffective and resulted in greater CO2 emissions. The market for a new technology that could make desalination cheaper and more effective would be enormous.

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is need for, among other things, genetically modified plants that can cope with a variety of weather conditions and give increased yields. New technology can ensure optimal soil fertilization and reduce plant disease and pests to an absolute minimum. New technology can also be used to assist agricultural production in places where water shortages are a growing problem.

- **MARKET.** The total agricultural area must be increased. Countries such as Russia and Ukraine have significant undeveloped areas that have previously been used as farmland. The potential is also great in Africa. But this needs investment – also in infrastructure. The world is focused on the African possibilities. The World Bank has already supplied significant sums of money towards achieving land use targets in Africa. The EU has given a billion euro to help achieve the same goal. Combine these increases with a new international free trade agreement that gives better access to markets, and the world will be well on its way towards resolving the food crisis.
- **GLOBAL LEADERSHIP.** It is vital to have a global leadership that thinks both globally and sustainably. It is necessary to place future land use targets in countries where the production is most effective and has the least impact on the environment and climate. For example, it must not be at the expense of deforestation, and should be placed to cause the minimal impact on water supplies. The International Food Policy Research Institute (IFPRI) has suggested that the G7 countries, together with the five major developing countries – China, India, Brazil, South Africa and Russia – and five of the world’s largest corn producers, including Australia and Ukraine, should together take an international leadership in food production. Together, these countries could accumulate stores that could be divided when problems and shortages arise. This could lead to a more stable and safe market where steep price rises can be avoided. This would minimize the most dramatic consequences for the world’s poorest, and pave the way for a better functioning global food market.

Romantic Notions

The realities of global food production are a long way from the

traditional picture of farming, based on notions of idyllic local farms where the pigs are pampered and chickens roam free.

To keep prices low, food production is becoming ever more intensive. High cost and wages dictate what, how much and how things are produced. There are 40 different types of broccoli in the world. The two sorts that can be bought in the supermarket are not the most nourishing but the biggest and most easily transported.

Food production is now global. Until bird influenza struck, half of all poultry sold in Europe came from Asia. This globalisation brings the risk of a super-fast spread of disease across borders, and a low chance of containing the spread.

One half of the world’s antibiotics are used in meat production, with the result that there are now infections that can not be treated with antibiotics because of a resistance.

The idyllic picture of farming and food production – perpetuated to a large extent by the food industry’s own marketing – is one of the major barriers that must be surmounted if the food crisis is to be resolved. A central part of the solution is concerned with improving efficiency: fertilization; pesticides; genetically modified crops that reaps higher yields; and increased industrialization to increase production.

Global food production is currently only just sufficient to meet the world’s demand. The world has produced more than it needs in only one year since 2000. It was literally the connection between supply and demand which caused the start of the food crisis two years ago. A number of the world’s leading corn producers, including Australia and Ukraine, encountered significant problems with the harvest. The shortage of corn came at a time when the world’s need for produce was increasing rapidly – partly because of the fast-growing population, and partly because a proportion of the population, especially in Asia, shifted to a more protein-rich diet. They were simply eating more meat instead of rice and bread – first and foremost because they now had the means. Meat production is an extremely ineffective way to generate calories. To produce one kilo of beef requires eight kilos of corn. Even though the world is now producing the food it needs, a global emergency plan does not exist to cope with another bad harvest. Over the last 30 years, a number of countries have systematically reduced their food stocks to reduce costs, among other reasons. But the last two years’ deficit has drained reserves. Wheat reserves are at the lowest level since 1978; corn reserves are at

Water management: To control the capacity of water in dams as well as management and flood systems is extremely complex. There is a huge market here for software that can handle the coordination challenges.

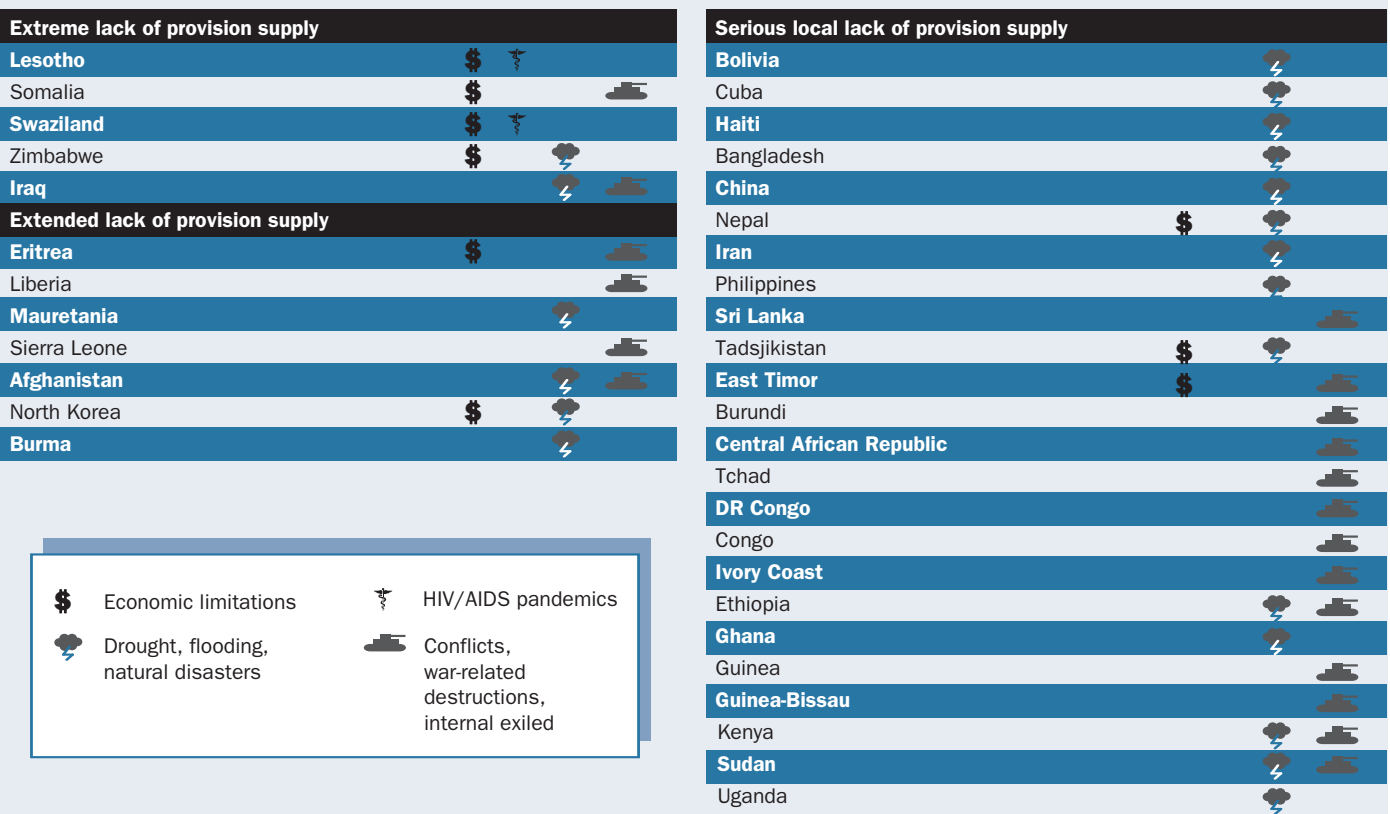
Disease control: With a growing global market for industrial produce, the need for analysis and control of food to prevent the spread of E.coli bacteria and other such diseases also increases. The control market is expected to grow to 2.4 billion dollars by 2012. European companies are world leaders in this field.

Halal production: A large proportion of the growing food requirement is in the Middle East. The market for Halal foods is increasing. The global Halal market is expected to more than double in the next couple of years from 200 billion dollars in 2007, to 500 billion dollars in 2010.

THE NEXT AGRICULTURAL REVOLUTION

MM | Victims of the crisis

36 countries in food crisis



Figur 1: 36 countries in the World find themselves in the midst of an extreme food crisis. Either because the harvest has failed completely because of weather and climate changes or because internal conflicts prevent provision production.

Source: FAO.

their lowest since 1996; and last year the global reserves of soya beans fell by 22 per cent.

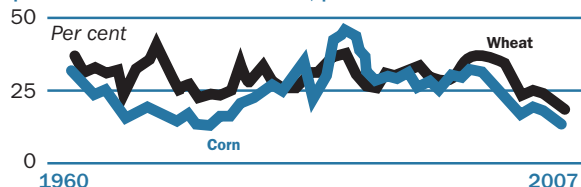
The food crisis could escalate quickly again if climate change or conflicts create new problems for production. Around the world, 36 countries have problems with meeting their own food supply needs (see figure 2).

One of the greatest problems of all for the future is the shortage of water. Already today, 1.1 billion people do not have access

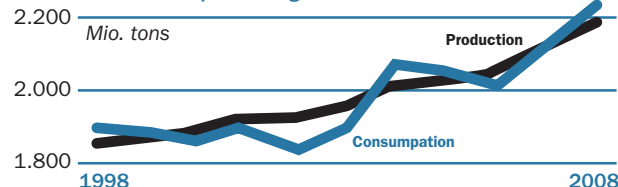
to clean drinking water. An even greater number of the world's population has problems with droughts and water shortages. This has not just affected developing countries but others including Australia, which is one of the world's largest food producers, and EU countries, where Spain, among others, has problems. Water shortages risk becoming a barrier to increased food production. One thousand litres of water is needed to produce one kilo of wheat; 1,400 litres to produce one kilo of rice; and 13,000

MM | The larder empties day by day

Development in corn and wheat stocks, per cent



Production and consumption of grain



Source: US Department of Agriculture, 2008.

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litres to produce one kilo of beef. The future of food production must focus on areas where there is access to water. At the same time, new strains of plants must be developed that require a substantially lower amount of water.

Dealing with climate change and security issues is necessary in order to secure stable food production in the long term. But, it is not a sufficient response to the acute need that already exists.

The immediate solutions to the food crisis rely on efficient use of land, increased investment and enabling profitability in food production. This requires global action, but some of the necessary solutions will be difficult to sell for the politicians who take the decisions.

New Technology

Organic food is a great success in the West. More and more farmers are allocating land to organic food production, for the simple reason that it can be sold for a higher price.

But if the organic movement was to become a global phenomenon, it would throw global food production into a deep crisis. If you remove artificial pesticides from global food production the yield would drop by between 10 and 25 per cent.

Fertilizers and pesticides are a central part of the answer to the world's future food needs. A large part of Africa's agricultural land yield is poor and lacking in nutrients.

Malawi is a good illustration of the difference between using fertilizer and not using it. Two years ago, Malawi was a net importer of corn. Two years after the government began distributing subsidised fertilizer, Malawi was a net exporter of corn to neighbouring countries.

Fertilizer is essential for developing efficient use of land in Africa. An independent African fertilizer production, which Nigeria has, can have great importance for development of the continent's agriculture.

Development of new crops will have the same impact. Many of the plant types currently grown in Africa give a poor yield. Development of new types that can withstand droughts, diseases and so on is underway. But this gives rise to significant political and ethical dilemmas. One of these concerns is the intellectual property rights to the new kinds of crop which, in many cases, are patented by multinational food giants. Another is the risks of allowing new strains of plants to be released into existing ecosystems. No one can predict the exact consequences. Is it right, for exam-

ple, to use Africa and India for experimentation when others, such as Europe, are extremely cautious regarding the planting of GMOs in their own agricultural land?

There are a number of areas in which wholly uncontroversial new technology can increase land productivity.

The new John Deere tractor has, for example, an intelligent plough which can analyse the earth while on the move, and tell exactly how much fertilizer is required. It can contribute to reducing over-fertilization and minimize global and local environmental problems.

A global satellite system currently being developed under the French space program will give a weekly detailed update of the earth's surface. Farmers will be able to use this to target use of plant fertilizers and pesticides so that they are not used as a preventative measure, as they are currently, but only sprayed when they are needed. As well as this, the satellite pictures and analysis can lead to a much more sensible management of water, which is a scarce resource.

Investment Problems

Technology and new plant strains are nowhere near sufficient to ensure a constant production growth of 2 per cent per year. This also requires an increase in the amount of agricultural land.

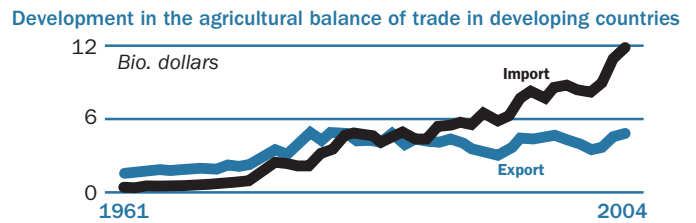
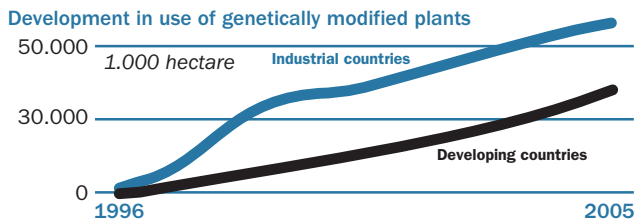
This is not an immediate problem. There is a great deal of fallow farm land. In recent times, both Russia and Ukraine have set aside a large part of their agricultural land because it was not profitable to farm after the wall came down. In Africa too, there is a vast amount of poorly utilized land.

But before anyone can begin to farm this unused land, someone must invest in it. The need for investment is considerable. The IFPRI estimates that it would cost 4-5 billion dollars per year to halve the effects of the food crisis in sub-Saharan Africa.

The need for investment in countries such as China and India has been evident for some time. India passed a National Agricultural Development Plan which involves investment of 6.1 billion dollars over the next four years. China has chosen to follow a similar path, and increased its annual budget for agricultural investment by 20 per cent.

The situation is different in Africa. Investment is made on the assumption of – or at least justified expectation of – the potential for profit. But banks judge agricultural production to be an uncertain and risky investment.

MM | The genetically modified plants grow in industrial countries – trade deficit grows in developing countries



Source: LEI – Wageningen UR og FAO.

THE NEXT AGRICULTURAL REVOLUTION

With the liquidity problems that the financial crisis has raised there is a much greater risk that it will become even more difficult to secure the necessary agricultural investment in the coming years. The question is whether India and China can and will meet their agricultural targets, and whether international institutions such as The World Bank will put further money into agriculture in Africa while international financial institutions are under pressure.

No Market

There are two factors in particular that make agriculture an uncertain investment: the weather and the market. In part, climate changes make it more difficult to predict whether a harvest will be successful or not. And also, there is the issue of whether produce can be sold – by no means a certainty.

Access to markets is, today, one of the greatest obstacles to securing food supply. The problem is twofold. Firstly, the absence of a well functioning national market – a problem which typically effects many parts of Africa. Secondly, a poorly functioning world market.

In Africa, the problems begin literally where the fields end. In many African countries, the infrastructure is so bad that it is often more cost-effective to purchase foodstuff from overseas, all the way from Asia for example, than to transport them from one corner of the country to the other.

For example, in the Democratic Republic of Congo there are only 59 kilometres of asphalt road for every million inhabitants. In Tanzania, there are 230 kilometres, while in India there are more than 1,000 kilometres.

If there is a road to the market, the question becomes whether it is possible to get a price that is sufficiently high in order that production and transportation is profitable. This explains the colossal support farmers in both USA and Europe receive – a model that is now being copied in countries such as Russia and India.

These are sensible measures that can be taken on a national level: conservation of nature, securing supply, regional politics and so on.

But in the global market the consequence of agricultural support is that ordinary market forces are ignored.

A well functioning global market requires a new global agreement that regulates the global trade of agricultural produce. The hope is that it could breathe new life into the stranded Doha-

round of trade talks within the World Trade Organisation (WTO), when the new American administration takes office in January.

The potential is enormous. If Africa can establish effective agricultural production that it can export to a global market, then according to the FAO, it could give a colossal lift to the entire continent's growth and employment.