

WORKING ON A RESILIENT FOOD SUPPLY

# Keeping the shelves



Women in Thies, Senegal, conserving green beans for their own use.

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**The world food supply can be made more resilient to price fluctuations, failed harvests and climate change. Socio-economic models show which investments are the most effective for boosting food security and economic development. 'This is based on trends that are already under way.'**

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**'B**ig fluctuations in food prices can be disastrous for sections of the population living at subsistence level. They have no reserves and can be made destitute by sudden and drastic price rises, even farmers who normally have some food themselves,' says development economist Thom Achterbosch of LEI Wageningen UR in The Hague.

And this, Achterbosch explains, poses a threat to food security, the guaranteed supply of sufficient, affordable food. The resilience of food systems in the face of disasters such as failed harvests and price fluctuations depends on a complex interplay of factors. These range from agricultural factors such as soil quality and land use to socio-economic factors such as the standard of living in a country, its public services and the strength of its currency. And then there is the steadily changing climate with the rising sea levels and temperatures it brings with it.

'In a country that is ill-equipped to cope with sedimentation or the exhaustion of farming land, farmers are already facing difficult conditions. Matters are made worse by unreliable weather due to climate change and expanding cities with strongly fluctuating food prices. With all the negative consequences this entails: poor harvests and empty shelves. This can increase tensions between sections of the population and

stimulate migration to the cities or abroad,' says Achterbosch.

Big food security issues are Achterbosch's daily fare. LEI Wageningen UR is working on various models intended to result in scenarios which will help European Union policymakers take more evidence-based decisions for improving world food security. The project is called FoodSecure and aims to combat the often disastrous effects of failed harvests and food losses, thus helping to reduce hunger and undernutrition in the world. The EU spends three billion euros of its annual development aid budget on food security around the world. 'That ranges from emergency aid and agricultural projects to adding iodine to flour, or awareness-raising campaigns about the benefits of breastfeeding,' says Achterbosch. 'On the basis of our models, we shall be offering policymakers instruments with which they can make better choices in developing a long-term strategy for food security for every country in the world. They will be able to choose from a range of different recommendations, such as putting more money and effort into accruing knowledge and strengthening collaboration in agricultural supply chains, removing trade barriers, or improving soils.'

To create a range of these recommended options, LEI Wageningen UR is collaborating on advanced model research with >





## ‘We can develop a long-term strategy for food security for every country’

American researchers at the International Food Policy Research Institute (IFPRI) in Washington, the Netherlands Environmental Assessment Agency, and the International Institute for Applied Systems Analysis (IIASA) in Vienna. ‘For each country or region we propose several possible paths it could take in its development up until 2050,’ says Achterbosch.

### BRINGING IN MONEY

Commercial crops bring in money with which food security can be improved and the food system can be made more resilient, suggest initial analyses by the FoodSecure project. There is more capital available for investments, which leads to innovation. In the wake of this traders and cooperatives often emerge, promoting further commercialization of the crops.

Take the successful green bean farmers of dirt-poor Senegal, for example. ‘Thanks to strong sales by Albert Heijn, Aldi and other global supermarkets, green beans have become a successful export product for Senegal in the last ten years. It is an important cash crop for the country, which offers a way out of poverty,’ says Achterbosch. ‘But not all farmers manage to meet Albert Heijn’s standards. Some families end up landless because they sell their land to the successful farmers.’ At the same time, the successful export farming swallows up land that is still being used to grow rice, Senegal’s staple food.

On balance, however, the bean farming seems to have been positive for economic development, as more money is flowing into Senegal. ‘There is money for artificial fertilizer and better vegetable seeds and rice varieties, which means more food can be grown on less land. Our models show how agriculture and food supply chains could develop in Senegal towards 2050, given the projected food requirements and population growth.’

Driven by the success of the green beans, food supply chains with a wider range of products can grow up around big cities such as Dakar. This is partly due to the emerging

middle class with more money to spend. ‘The model highlights promising sectors for supplying protein, such as poultry keeping, beef cattle farming or combinations of these. The poultry sector is booming all over Africa in fact, since it is not land-dependent.’ This kind of diversification can improve the food supply all down the line, especially if sustainability criteria are built in. Bean and rice farming must not be allowed to exhaust the soils; poultry farming must not pollute water supplies.

The models could be of interest to the Dutch agrifood sector too, Achterbosch believes. ‘There could be breeding programmes for productive cows suited to conditions in West Africa, for instance.’ Such developments show up in the results of the models, says Achterbosch: ‘We try to forecast these developments up to 2050.’ The researchers use statistical methods to try to determine which factors are decisive. What happens to food prices, for instance, is a crucial factor for future agricultural development. It is often suggested that food prices will soar because of the rising world population. LEI Wageningen UR has a different take on this. ‘Our estimate is that the food price index will not change dramatically between 2005 and 2050,’ says Thom Achterbosch. ‘With plausible assumptions about population growth and economic development, projections from a range of models, including our MAGNET model, vary from a fall in prices of 25 percent due to developments on the technical and productivity fronts, to a rise of 50 percent. The latter would mean an annual price rise of 1 percent maximum. We double-check assumptions and uncertainties about

this with other model researchers in order to offer policymakers a better service.’

### BORDERLINE

Just as crucial are the models which calculate future changes in land use and agricultural systems, such as the rise of livestock farming in Africa. Models which forecast the effects of climate change, too, are combined with the socio-economic and agricultural models. ‘We can predict the likeliest trend in land use as well as socio-economic developments given a temperature rise of 2 degrees Celsius, which is already borderline. But we can, if anyone wishes, show what will happen if the temperature goes up by 3 degrees.’ On a global scale this latter scenario would probably lead to a decline in agricultural productivity and higher food prices, which would also fluctuate wildly. This would also undermine the self-reliance of vulnerable societies when hit by natural disasters or economic downturns.

The data analysis has already thrown up some surprising outcomes. ‘In general, undernutrition goes down in a country when the gross national product goes up,’ says Achterbosch. Stunting among children, for instance, goes down by 6 percent when the per capita income rises steadily by 10 percent. ‘In Nicaragua, however, a decrease in undernutrition was observed in the absence of economic growth. By contrast, the strong growth in India has hardly been accompanied by any drop in undernutrition,’ says Achterbosch. So something else must be going on there. ‘The caste system, for example, means the economic growth is unequally distributed.’

Achterbosch and his colleagues at LEI Wageningen UR are also working on ways of integrating what is being called ‘nutritional security’ into the models. ‘Nutritional security is a somewhat clumsy concept which is used to identify the quality of the consumption pattern,’ explains Achterbosch. Besides the simple availability of sufficient calories (food security) the important thing in most countries is a healthy and varied diet without too much sugar or fat: nutritional security.

‘A rise in income of 10 percent leads to a 7 percent rise in overweight among women. It is clear that poor nutritional security can eventually have a negative impact on a country’s socio-economic development, for instance through obesity, cardiovascular disease and diabetes. The models can provide insights into the effects of a changing diet on a country.’ The writing is on the wall in many African and Asian cities where a slightly wealthier middle class has grown up and consumers are exchanging their original rural diet of grains and pulses for meat, sugar and soft drinks.

### TIMES OF SCARCITY

Achterbosch thinks his research can really contribute to increasing the resilience and robustness of food systems. ‘Our models can generate insights with which both policymakers in Brussels and individual countries can adapt their agricultural policies. For example, the billions of euros in European development aid funding could be used more for innovation, or the World Trade Organization’s rules could be adapted so that grain keeps on flowing to areas that depend on it even during times of scarcity.’

All this calls for more than just academic knowledge. Achterbosch: ‘The scenarios and models have been discussed with lots of stakeholders such as businesses and NGOs. So this is based on trends that are already under way. It is important to steer them in the right direction so as to reduce poverty and hunger around the world.’ ■

[www.wageningenur.nl/en/resilience](http://www.wageningenur.nl/en/resilience)



### INVESTMENT THEME RESILIENCE

Resilience is a crucial quality for natural and agricultural ecosystems as well as for the economy or an individual organism. Resilience determines the response to sudden changes such as technical progress, climate change or socioeconomic developments. This resilience will be one of the spearheads of Wageningen UR’s research in the coming years.

Take pig-farming. Because feed is imported, pig farms have traditionally been located close to harbours. ‘That led not only to environmental and health problems but also to a strong orientation to cost price,’ says Krijn Poppe, research manager at LEI Wageningen UR. The sector also faces criticism focused on animal welfare. ‘The question is whether this system can adapt,’ says Poppe. ‘And in what direction adaptation will go: less meat-eating, a more expensive production process and making meat more expensive, or moving production to areas where the feed is grown?’

Resilience is already an important theme for Wageningen UR in several scientific fields. Many of the underlying principles, such as mathematical and experimental approaches, are universally applicable. Professor Marten Scheffer is one of the people who have made their names with this concept. Poppe: ‘In the first instance the researchers are obviously looking for scientific insights, but there is interest in companies too in gaining a better understanding of how systems can be made more robust. Wageningen UR is working on new interdisciplinary applications of resilience in order to bring more depth and breadth to the research on it.’

Poppe illustrates the complexity of the issue with a story about climate change in Greenland in the Middle Ages, which led to the decline of the Vikings. ‘The cause of that was not just that it got colder. The problem was also at the cultural and institutional level. There was overgrazing, which did not bother the elite because it gave them more power over the farmers. That overgrazing might not have been fatal if the Vikings had learned to eat fish, but strangely enough these seafarers were not fishers. They could have picked it up from the Inuit who were coming in.’