

Food security and the futures of farms

2020 and toward 2050



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Food security and the futures of farms 2020 and toward 2050

Report from the Bertebos Conference in Falkenberg, Sweden, 29–31 August 2010.
Key note speaker was Professor Joachim von Braun, Bertebos Prize Winner 2009.

The Royal Swedish Academy of Agriculture and Forestry
in cooperation with the Bertebos Foundation.



THE BERTEBOS FOUNDATION was established in 1994 by Olof and Brita Stenström to promote training and scientific research within the food sector. The Bertebos Prize is awarded every second year for research of distinguished quality and practical use in food, agriculture, ecology and animal health.

In 2009, Professor Joachim von Braun was awarded the Bertebos Prize for his efforts in drawing attention to the world food crisis. He has performed outstanding work in development economics and as effective head of several development research institutions focusing on food, agriculture and rural poverty.

From 2002 to 2004, he was Director General of the International Food Policy Research Institute (IFPRI), which formulated successful new policy initiatives relating to trade and aid, famine and health and nutrition. Professor von Braun is active as member of many scientific advisory boards dealing with agriculture in developing countries.

Bertebos Prize winners

- 2009 Professor Joachim von Braun, Bonn, Germany
– Food security and the futures of farms: 2020 and towards 2050 –
- 2007 Professor Ingo Potrykus, Magden, Switzerland
– Genetic engineering for bio-fortification of plants –
- 2005 Professor Piotr Kowalik, Gdansk University of Technology, Poland
– Water dynamics in agriculture and forestry –
- 2003 Professor Erik Steen Jensen and Professor John R. Porter, KVL, Denmark
– Soil biology and modelling of responses of agro ecosystems to their environment –
- 2001 Professor Donald Grierson, University of Nottingham, UK
– Genetical engineering and food –
- 1999 Professor Wolfgang Witte, Robert Koch Institute, Wernigerode, Germany
– Antibiotics in food and feed –
- 1997 Professor Christopher Polge, University of Cambridge, UK
– Preservation of animal semen –

Contents

FOREWORD.....7

HOW WILL FOOD SECURITY AND FARMS CHANGE?

Food security and the futures of farms9

The next fifty years and the role of history in future studies.....17

SMALL FARM AGRICULTURE AND THE CHANGING LINKS TO CONSUMERS

Agricultural change and food security in China..... 22

African agriculture and change in the small farm sector 26

Food security and small-scale farming in India 30

LARGE SCALE AGRICULTURE, TECHNOLOGY AND FOOD SECURITY

Brazilian agriculture, its productivity and change 35

Russian agriculture and its structural change 39

FOOD SECURITY AND THE FUTURES OF FARMS

An attempt at synthesis 43

Panel discussion..... 48

SPEAKERS' PROFILES..... 52

THE TWO-DAY BERTEBOS CONFERENCE 2010 took place in August 2010 at Elite Hotel Strandbaden in Falkenberg, Sweden. The conference was chaired by Sara von Arnold, the President of the Royal Swedish Academy of Agriculture and Forestry (KSLA). It comprised four sessions, the first three with presentations, each ending with a short discussion, and the fourth with synthesis and panel discussion. Each session had its own chair person:

How will food security and farms change?

Professor Sara von Arnold, chair

Small farm agriculture and the changing links to consumers

Dr. h.c. Annika Åhnberg, chair

Large-scale agriculture, technology and food security

Professor Peter Sylwan, chair

Food security and the futures of farms

Professor Robert Thompson, chair

This report is a documentation of the presentations, prepared by a text-writer in collaboration with each speaker.

The conference was planned by Joachim von Braun, Ewa Rabinowicz and Åke Barklund. It also included an excursion to two of the Bertebos Foundation's four companies; the mill Berte Qvarn AB, which was built in the Middle Ages but is today completely modern however still situated in the old premises; and the ice-cream factory SIA Glass AB with a share of close to one fifth of the Swedish market. Members of the Stenström family hosted the dinner and events.

Foreword

ÅKE BARKLUND

An excellent way to discuss farming and food security is to invite people from various parts of the world, with outstanding knowledge about the topic, and listen to their experiences and views. The Bertebos Conference 2010 offered such an opportunity. We learnt that there is no blueprint for agricultural development. History as well as the present conditions, both exogenous and endogenous factors, influence the progress, and each case needs its own analysis. With Russia for example, it is quite important to know and reflect over its history when examining the current agricultural development. In spite of all differences, we can still learn much from each other.

Farm size is a common topic of debate among agricultural development specialists. Many believe that structure rationalization to larger farm sizes is a prerequisite for positive change, as it was in Europe. That is not always the case. More important is to increase productivity, such as crop yield per hectare or degree of added value, both measured in monetary terms. If other sectors can absorb excess farm labour, a natural way to increase farm productivity is to mechanize and let fewer people do the farming. Unfortunately, jobs outside farming are often not abundant.

China and India have similar situations with many very small farms. Small, non-expensive agro-machines are introduced individually or jointly, or entrepreneurs offer their services to mechanize the heaviest and most time-consuming work. The farmers can use the spared hours for more work-intensive and/or better paid crops, for activities to add value in the food chain or for nearby non-farming jobs. In pace with the rapid industrial development, many men are working in urban areas, leaving the farming to the women. More attention is therefore given to the special female-farmer issues, as well as to basic education for rural people.

The main reason behind the Brazilian success is their powerful investment in science and technology, continuously since the early 1970s. The Brazilian history and the present conditions—that led to such a spectacular and unique agro boom—are of course special for the country. However, some lessons are generic: the total belief that “agriculture is the future”, the massive and long-term focus on agro-research, and the constant linking of farming to agribusiness.

Agriculture is an effective way to counteract poverty. A 10 percent increase in farm yield can reduce poverty by 7 percent! Africa holds great opportunities for agriculture. The continent is agro-ecologically and socio-economically very diverse, which means there is likely room for several ways forward, including large-scale, highly mechanized farming. Nevertheless, far into the future, most of Africa’s farmland will be cultivated by small-scale farmers—increasingly women. Basic problems in many African countries are weak leadership and bad governance, affecting the whole society. However, some years back the African Union’s agricultural wing recommended all member countries to triple their investments in agriculture and spend a minimum of 10 percent of their gross domestic product (GDP) on agricultural development.

Most of the African farmland is extremely nutrient poor. A common view among western environmentalists is that nitrogen-phosphorous-potassium (NPK) fertilizers should be banned

in favour of manure and compost. For Africa, that is destructive. All types of fertilizers should of course be used, whether they are brown, green or white. Availability and affordability—not dogmatism—should decide which type to use and normally, as in other parts of the world, we will most likely see a mix of the three. Cows eating weak grass, drop weak dung!

Another curious idea aired by some western non-governmental organizations is that credits, *per se*, are bad for African farmers. Unfair loans are of course bad, but one of the most basic roles for governments and banks is to offer sensible credits for their farmers.

An experience from all countries is that individual small-scale farmers are looked upon as “no one”. Farmers must be encouraged and supported to organize themselves, to get favourable credits and necessary policies in place, obtain knowledge about and influence over the markets and together get access to affordable farm inputs (like certified seeds and fertilizers).

Man is most likely the only creature on earth able to exceed what we today define as the “natural” limits for our survival. But man is probably also the only creature able to stretch those limits beyond what was yesterday regarded as the “natural” limit. Information technology, bioscience and other disciplines are continuously moving these “natural” limits, thereby giving us an endurable future. People with a decent standard of living care about the environment and give birth to fewer children, compared with the really poor who can’t afford that.

Åke Barklund
Secretary General, Managing Director
Royal Swedish Academy of Agriculture and Forestry (KSLA)

Food security and the futures of farms

JOACHIM VON BRAUN

Food security, poverty and agriculture are intertwined, and the probability of eliminating food insecurity depends on various factors. The presentation focused on the units where food is produced—the farms and their people—and the seven mega trends driving farming. It ended with some perspectives on how farms might transform to have a positive future. The paper presents an optimistic view on the futures of farms but also points to needed policy actions for achieving it. There will not be one future of farms but due to the tremendous diversity of farming and the changing settings in which farming evolves, there will be multiple futures of farms.

Change of farms

The fundamental forces which are driving farm change can be broadly clustered into those that are exogenous and those that are endogenous. The *exogenous drivers* are embedded in the existing situation: location, demographics, institutional arrangements, ecology, nature, infrastructure, etc., which are inherited over a long period of time and create all sorts of path dependency in change. The *endogenous forces* are driven and constrained by current and traditional institutions and farm structures. Separating exogenous from endogenous drivers is rather important to this discussion.

The majority of farms in the world are smaller than two hectares. Not counting the miniature but also relevant garden plots of less than 0.1 hectares, the number of farms amounts to 530 millions (table 1). Large farms are a minority, both in numbers and in coverage of land area. Analysing the transformation of farms during the last 40 years can give an idea of what will happen in farming during the next 40 years. In general, the farms in the richer countries became fewer in numbers and larger

in size, while all over the developing world, the numbers of farms have increased while the farm size has declined.

Table 1. The majority of the world’s farms are small.

Farm size (ha)	Percent (%) of all farms	Number of farms (millions)
< 2	85	451
2–10	12	62
10–100	2.7	14
>100	0.6	3
Total	100	530

Source: World Census of Agriculture. Food and Agriculture Organization of the United Nations (FAO). Excluding farms under 0.1 hectares.

Why are the farms getting smaller? There are several reasons. Inheritance traditions, splitting the farms as a new generation takes over, is a common explanation. Production efficiency and household economic forces contribute to this development.

Recently, I spent time at a farm in Rwanda that I had last visited 23 years ago as part of a survey I conducted. I was curious to find out what had happened to the farm that had been 0.4 hectares at the time. The farm was now split up among three sons and the parents who are in their seventies and still farming, and now everyone has only 0.1 hectare. That is a generational change in the most populated parts of Africa. In that location, there will be no future if the next generation again divides the land equally. Obviously, people there need other jobs.

What is the optimal farm size? That is a long-standing, never ending debate among agricultural economists. Basically, it is context specific and a function of labour productivity inside versus outside of agriculture.

In any case, spontaneous enlargements of farm sizes in developing countries cannot be expected to take place quickly. Making an extreme assumption of farm closure rates of five percent per annum, would mean that five percent of farmers give up their farms and the families move on, every year. Europe has only managed that process with half such an exit rate. With five percent, it would take 45 years to

move from an average of one-hectare farms to an average of ten-hectare farms, not really large but still a big change. Farm transformation takes time—these small farms will be there for many years to come. Radically accelerated and enforced change in farm size usually entails suffering and is economically inefficient.

Taking a more sociological approach toward answering the question, why peasants remain peasants and show so much resilience, van der Ploeg (2008) includes other drivers. The political environment or the marginalization of the peasant communities creates resistance and cooperation. The results of these efforts are self-contained socioeconomic units that have taken shape over long times and show tremendous resilience.

The large farm economy, on the other hand, prevails in parts of Latin America, North America and Australia, and the former Soviet Union, but rarely elsewhere (figure 1). This will gradually change and include parts of Africa, where large farm investment such as revitalizing plantation agriculture and foreign agricultural investment in large-scale farming is currently on the upswing.

Figure 1. Number and distribution of farms larger than 500 hectares.



Sources: United States Department of Agriculture, 2007; Statistisches Bundesamt, 2008; Institute of Agricultural Development in Central and Eastern Europe from Goskomstat, 2006/07 and World Census of Agriculture, 1990.

Mega trends driving farm transformation

Seven mega trends

There are seven mega trends shaping farm economics. Each of these trends plays a role in shaping the scenarios for the futures of farms. The mega trends are the following:

- 1. Demographics of farm populations and labour.
- 2. Change in demand for food.
- 3. Prices of outputs and resources.
- 4. Information and communications technology, rural services, and infrastructure.
- 5. Climate change.
- 6. Agricultural science and technology.
- 7. Changing political economy of food and farming.

It is important to note that even though agriculture is *driven* by economic and socio-logical forces, agriculture itself is also *driving* change in the economy and society.

1. Demographics of farm populations and labour

Currently, the world population reaches 6.7 billion people, and is estimated to increase with a third over the next 40 years. As the world population increases, the farm population will increase in absolute numbers too, but as the world is becoming more and more urbanized, the share of the total population living on farms will decrease (table 2).

The absolute mega-driver of change is the change in global employment. The total number of employed people will increase from 3 billion to 3.5 billion people by 2020. The number of those employed in farming will decrease by 0.3 billion. This means an increase of employment outside agriculture by 0.8 billion. However, all of those will not be employed in urban areas. At least half of them will find their employment in the industry and services sectors in rural areas, namely in the small rural centres and towns (table 3).

Table 2. Farm population 1981 and 2005, increasing numbers and decreasing shares.

Region	People living on farms (million)		People living on farms/ total population (%)	
	1981	2005	1981	2005
Eastern Africa	125	217	83	75
Central Africa	41	66	74	60
Western Africa	88	126	64	48
Latin America/Caribbean	127	103	34	18
Eastern Asia	770	853	72	61
Southern Asia	612	787	64	51
South-eastern Asia	216	258	59	46
United States of America	8	6	4	2
European Union	54	26	12	5
World	2,216	2,604	49	40

Source: FAOSTAT, Michael Lipton, *Land Reform in Developing Countries*, 2009.

Table 3. Global employment 2005 to 2020, billion people.

	Employment on farms	Employment in services and industry in rural areas	Employment in services and industry in urban areas	Total employment
2005	0.9	0.6	1.5	3.0
2020	0.6	1.0	1.9	3.5
Change	-0.3	+0.4	+0.4	+0.5

Estimates based on the International Labour Organization's economically active populations projections and own estimates of sector shares, 2005.

2. Change in demand for food

The world population is estimated to reach about 9 billion by 2050 and these people will want to eat like 12 billion compared to today, because they will be richer and more urbanized. The volume and patterns of consumption will change. The western middle-income society is the trendsetter. People will eat more packaged food, more diverse and more fast food. The consumption of animal products, such as milk, eggs and meat (especially poultry and pork) will increase. The world chicken population already outnumbers humans by a factor of three and is predicted to increase further to 30 billion by 2050. The production will be rather large scale with backyard production gradually disappearing. Hopefully, there will be more attention to animal welfare standards. The pig population and production will grow in a similar way, while the number of cows will stagnate and instead they will become a lot more feed efficient.

3. Prices of outputs and resources

A trend that will not vanish is the “financialization” of agricultural production and agricultural markets, which is a more recent phenomenon of globalization. For the last hundred years, there was no correlation between financial crises and

food price indexes, at least not until the early 1990s. Thereafter, they have become statistically closely related and food prices have become increasingly volatile. These drivers are partly endogenous and partly exogenous.

In a similar way, globalization has led to new investment approaches towards agriculture. Portfolios of financial investment more and more include investment in food commodities. Financial markets and food markets have started to become linked, and especially more so in the last five years. Recall the food price spikes of 2008 as well as the smaller wheat and maize price increase in 2010. The consequences of these trends towards higher prices and their volatility influence the costs of natural resources. As food prices increase, the pricing of natural resources is affected with prices for land and water rising as a consequence of expected higher output prices. There is now an active international demand for land, and when that is realized in doubtful transactions, it is called “land grabbing”. Currently, most such land grabbing takes place in Africa, although it occurs also in parts of eastern Europe and Asia. These pursuits may further undermine the sustainability of agriculture. We now observe an internationalization of land markets.



Cell phones are soon in every person's possession, also in rural areas. Photo: courtesy of the International Food Policy Research Institute (IFPRI). © 2004 Jacob Silberberg, Panos Pictures.

4. ICT, rural services, and infrastructure

The mega-trend of increasing access to information and communications technology cannot be emphasized enough. It will give a boost to rural areas, and it will change the whole landscape of infrastructure. Not long ago, this trend only entailed cell phones, which are soon in everyone's possession all over the world. Currently, there is a fast expansion in internet access. Fibre optic cables are being pulled through Africa as we

speak. This development will change the environment also for small farms. It will facilitate access to rural services and completely revise the idea of a country or region being landlocked. This will certainly change the future of farms and the landscape of agricultural productivity.

5. Climate change

Climate change will increase the risks of farming. Production patterns will have to change and require fast adaptation accompanied by intensive research and much more knowledgeable and competent extension services. Maize production, for example, will have to shift to new geographical areas. The responses to climate change are very science-intensive, and it is important to invest in climate change research. Not acting in this field will come with extremely high costs. Productivity will play a key role since higher productivity will reduce greenhouse gas emission per unit of production. High productivity, therefore, is good for sustainable agriculture.

6. Agricultural science and technology

Investments in science will have a fundamental impact on which food prices the next generation will have to pay, and what extent of hunger it will experience. There is an urgent need for increased agricultural research investments and enhanced natural resources management and market efficiency together with effective policies.

The major technological changes in the next forty years will not be in the grain sector, but in the meat and dairy sectors. Examples are as follows:

- In vitro production of meat.
- Innovative non-meat products derived from soybeans.

7. Changing political economy of food and farming

In 40 years, there will probably be a slightly smaller number of farmers in the world with somewhat larger farms. As the resources they govern and the assets they manage will become more valuable, these farmers are going to be more powerful than they are today. Farmers' organizations become stronger and more capable to reflect the diverse, southern and global farming communities, and are therefore better positioned to deal with a globalized agriculture.

However, we have to be aware of possible new political developments. A hundred years ago, most predictions on what kind of event would have a big impact on farming for the coming hundred years would have been wrong. People would have thought of technological change, infrastructure and other innovations. But the greatest impacts have been the "...isms", like the persistent feudalism, colonialism and communism. Probably this century will also not be free of "...isms".

Food security, poverty and agriculture

Food insecurity prevails among the poor. To focus on food security, therefore, means to focus on poor people! Although the occurrence of poverty as share of the population is highest in Africa, in absolute numbers India and eastern Asia are more affected (figures 2 and 3). And among the population, those most affected by food insecurity are the smallholder farmers. Therefore, if these farmers were better off, hunger would decline. Unfortunately, the trends of food security have been negative in recent years: according to FAO statistics, hunger has increased since 1995.

The "sticky problem" of child malnutrition is diminishing only very slowly. The largest number of undernourished children is living

on small farms. Gender equity, sanitation, health and agricultural development would make a significant contribution to reducing the problem. Improving the economic situation for small-scale farmers would have an impact on all three dimensions of food security: availability, access and utilization.

Future of farms and strategies

By investing more in farms, and by increasing efficiency of farming, a large part of global poverty and hunger could be reduced. We should pursue the following goals for global agriculture:

- All people have access to sufficient, healthy, affordable food.
- Environmental resources and nature is effectively managed and conserved.
- In emerging economies, agriculture is a driving force of sustainable growth and development.

Currently, these goals are somewhat conflicting. To integrate them science and technology are the keys.

Strategies of smallholders to grow out of poverty are in principle these three:

- Growth in farming through expansion, commercialization, specialization and diversification.
- Part-time farming with additional off-farm rural income.
- Exit farming altogether.

Strategies for agriculture to respond to the goals above, entails redefining agriculture. Traditionally, agriculture meant farms, forests and fish. In the future, agriculture will entail the whole value chain, including agri-business and retail revolution, also ecosystems services, and linkages to bio-economy, thus:

Figure 2. Percentage of the population living on less than USD 1.25 per person.

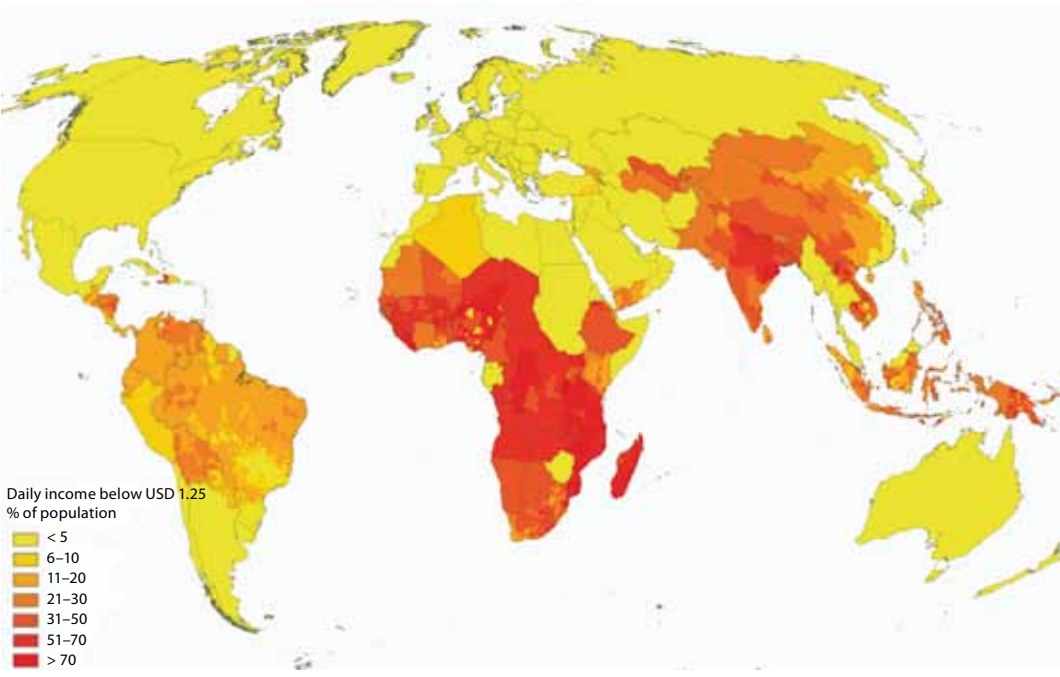
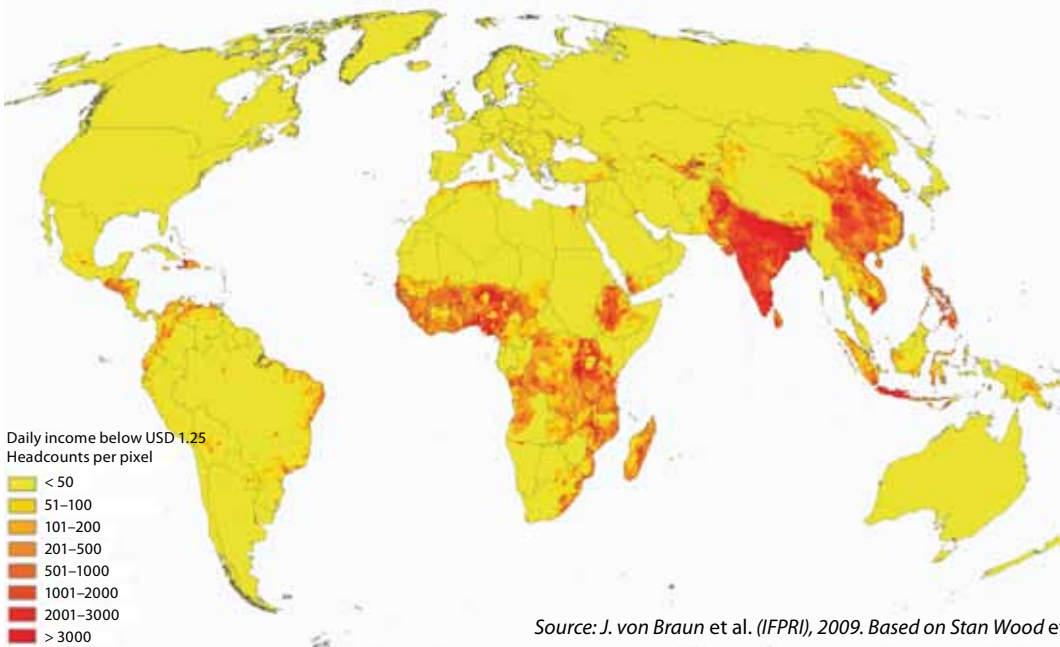


Figure 3. Absolute number of the population living on less than USD 1.25 per day.



Source: J. von Braun et al. (IFPRI), 2009. Based on Stan Wood et al.

- Not just one value chain but many joint systems of value chains, with a growing importance of biomass and of quality of bio-based products.
- New products, raw materials, bio-refineries, and transformation towards a knowledge-based bio-economy.

In conclusion

- Small farms get smaller in developing countries.
- Large farms get larger in middle- and high-income countries.
- Small farms do not grow quickly with economic development.
- Productivity will play a key role since higher productivity will reduce greenhouse gas emission per unit of production. Therefore, high productivity is good for sustainability.

The future of farm families and food security depend on:

- Agricultural growth accompanied by technological and institutional innovations.
- Open trade, reduced market volatility and migration options.
- Improved rural education, nutrition and health policy.
- Strengthened human and property rights and a political voice.

There will be multiple futures for farms, and appropriate policies in the specific context will play key roles. Increased voice of farmers will be essential for policy change. There is a good chance that today's absolute poverty on farms will be overcome in the coming generation.

The next fifty years and the role of history in future studies

JANKEN MYRDAL

Only for the last fifty years has future studies been a subject by itself. It has been coloured by both the extreme optimistic view, usually neoclassic economics with the idea that we can just go on forever, to the most pessimistic, usually biologists who view humans as an evolutionary mistake, but happily enough it is all over soon. This paper holds an optimistic view, somewhere between these two extremes. The hypothesis is that we live in the shadow of a Major Crisis, and this is the reason why the catastrophe will not occur. On the other hand are there urgent needs for us to take responsibility for the future of humanity.

Future studies

After World War II, future studies became founded as a discipline, instigated by the threat of nuclear war. A collection of study methods was developed, the same main ones as still used today (box next page). The various methods give different kinds of information and are useful for different purposes, mainly for short-term predictions. When the interest of the studies is the far future, the result of most methods will be overcome by trend breaking incidents.

Longer-term predictions require wider viewpoints and historical insights. When analysing one sector, like agriculture, and fifty years into the future, global perspectives and also other sectors have to be included.

The method preferred here is following long-term historical trajectories, which offer the broader perspective, necessary considering the problems humankind faces, such as climate change, depletion of resources, etc.

Crises

The world of today is regularly haunted by the threat of various crises. These crises usually turn out to be of minor importance, like mad cow disease, although there are larger threats, such as climate change, oil peak or overpopulation. Why do people worry so much over crises? There may be several explanations, but one interpretation is that the fears are justified and founded in real threats.

The human societies often tend to go to the extreme. Our creativity, which has shaped us as humans, is leading us to find solutions to fulfil our needs. And this creativity has the effect that we can imagine what does exist, and what does not exist. The human capacity to conquer nature, together with our awareness that we can do it, is not making us less dependent on nature, rather the opposite. People have the means to reach the limit of the possible. And when we have reached it, we are more restrained by nature than any other animal. This tendency

Methods for future studies

Interviewing people includes asking experts (the so called Delphi method), young people (who will act in future), those in power (who decide over our future) and other futurologists to predict change. The advantage of this method is that it gives a spectrum of views and ideas. The disadvantage is that the replies reflect each person's horizon or knowledge, and possibly give answers promoting their own interests.

Interpreting trends and extrapolating them into the future is a common method. The advantage is that it gives hard facts. The problem is that trends can change: there are breakthroughs, upturns and downturns. Therefore, most trend interpretations can only be used for shorter periods like five to ten years. For longer prognosis, like 50 years, most of these trends will only deceive us.

Intuitive methods are closely related to fictional creation used in literature, movies and computer games. They may provide insights worth consideration, and helps in understanding how people in general envision their future. However, the shortcoming is that isolated aspects often become spotlighted.

Creating scenarios combine several alternatives and factors. It is often presented as a method in itself, although it combines several methods. The goal is to avoid biased interpretations, while the problem is that it often gives a rather static picture. Scenarios can be useful to present studies instead of being a method.

Historical methods build on the theoretical principle that the future is a continuation of history, and by understanding the past, it is possible to create historical trajectories (non-linear courses of change) and extend them into likely futures. Contrary to analysing trends, the trajectories are based on a historical theory about upturns and downturns. The future will more look like a continuation of history. And to look far into the future, one has to start in the distant past. The problem is that detailed predictions for the immediate future cannot be made.

to go over the limit of the resources makes the human society more vulnerable to a catastrophe or disaster.

Midwife for change

In general, crises seem to be an inevitable part of human history, and they serve as the midwife for structural change.

If the reserve capacity, for some reason such as overpopulation or resource depletion, is too

small when a disaster strikes, it could force the whole society into a vicious circle, such as the Roman or Maya collapse.

However, most often humans find a solution and recover after the crisis. As a matter of fact, crises have often brought social and structural change, resulting in further development. A typical example occurred after the Black Death. When the economic and social structure was remoulded, it paved the way for the next upsurge; the strong state and economic expansion in the

16th century, which helped Europe conquer the world. In China, there was a similar change after the downturn of the reign of the Mongols.

In the shadow of a Major Crisis

The question is: where are we now? We are obviously not in a deep crisis. But it seems like we are constantly pre-active for it, acting as if the crisis is just around the corner. And the reason for this is that our technical power and the society's complexity are so great, that major crises, vicious circles, if released could lead to massive destruction of life and environment or devastating nuclear wars fought over resources in short supply. Therefore we have to be alert and pre-active.

Below is a list of major threats from 1950 and onwards, sequenced after—not when they became threats but—*when they started to be discussed, worldwide*. There is at least one for each decennium.

- **Nuclear war**, 1950s and 1960s. This is still a threat, especially in upcoming wars over resources.
- **Overpopulation**, 1950s to 1980s (partly solved by the Green Revolution) and again from 2010 and onwards.
- **Environmental toxins** in soil, water and air, from the 1960s and onwards.
- **Shortages of oils and minerals**, from the 1970s and onwards.
- **Reduced biodiversity and destruction of cultural historical values**, starting in the 1980s.
- **Shortages of land and water**, from the 1980s and onwards.
- **Climate change**, from around 2000 and onwards.
- **Diseases**, such as antibiotic resistance, pandemics, impacts on human bodies of new mate-

rials and technology, possibly from around 2010 and onwards.

The interesting question here is not when they became a threat, but *when people identified the danger and started taking action*. It is my hope that we will manage to solve these problems.

The Green Revolution is often mentioned as having (at least partly) solved one large threat. Nuclear war was another real threat in the 1950s. During the 1950s and 1960s, people all over the world discussed this issue, and formed a global mentality with an interesting consequence. Since the end of the World War II, nuclear weapons have not been used in one single conflict! Not even when the nuclear powers faced defeat, like the United States in Vietnam and the Soviet Union in Afghanistan. Because the use of just one bomb would be so stigmatizing for the whole nation, for the politicians, and for the people in that nation, that it became impossible for the military to use this weapon. This can be conceived as one of the great moral victories of humankind.

The point is that we have had, for fifty years, an ongoing discussion on the human capacity to self-destruction. That is typical for our period.

Technology

The invention of new technology is one of the real mega-trends in human history. Together with art and religion, technology change has been there since the dawn of humankind as one of the marks of our species. The reason why we tend to overlook pre-industrial technology developments is that although the relative change in a low-technological society can be large, like the bow of a sickle or the shape of the share of a plough, for us they appear minor.

In general, new technology is not introduced as isolated novelties, but as systems of interre-

lated innovations. And like all system-bound transformations, technology change comes in leaps, followed by periods of relative stagnation. Some such leaps through history were the introduction of agriculture, the iron-revolution and the industrialization. Currently, we are in one of the big leaps forward, driven by the fast development of computers. In every branch or science, there are fast advancements made possible by computer power.

After an initial breakthrough, there is often a subsequent phase (a second leap) in which the new technical principles are intensified. My prediction is that there will be a stagnation phase—perhaps within a couple of decades, and thereafter a second leap of computer technology, when we will reach powers which we only vaguely can conceive. In addition, new technology will increasingly be oriented towards counteracting the adverse impacts of modern materialism.

An alternative interpretation is that the course of history has changed too fundamentally; that humankind has entered an era of constant technological leaps and will never again experience any stagnation phases. But that would be a surprise to historians.

Some scenarios

Futurologist David Martin¹ has described the next fifty years as humanity flowing on a raft down a canyon, rapidly approaching the bottleneck with its fast currents. The world population will be at its highest while the world's resources are undergoing great stress. At the same time, technology is developing with high speed. His prediction is that if we are to survive this fast and dangerous trip, humanity will have to develop "different rules of behaviour and very different technology".

1. Martin 2006, p 7–8:375

The question is: will technology develop fast enough to solve our problems?

I believe that in hundred years, we will have technology we cannot even imagine today. We will produce new materials; have sufficient energy sources, etc. The problem is how to cope during the next fifty years. And that is not only a matter of inventing new technology. I foresee a discussion about responsibility for the use of the new technology to open up.

For the next fifty years, there are three main possible scenarios:

1. The ongoing technology revolution solves our problems and allows us to go on without any tiresome and distressing change of habits.
2. The technology change is combined with a change of acceptable consumption.
3. The Major Crisis is released, gradually or suddenly, and people end up living in a catastrophe movie, leading a wretched life in the post nuclear war ruins of a resource depleted world.

If concentrating on the second scenario: how can new norms and habits come around? Human needs are governed by social norms, and there have been changes before. Smoking, for example, was once socially acceptable and considered a pleasure. A rather fast change of social norm combined with legislation soon reduced the habit. One possible way to change norms is through global discussions made possible by the new communication techniques.

Globalization

Globalization is often held forward as our most significant social movement today. However, following a historical trajectory, this is only one of many globalizations. There have been several leaps forward; the oceanic trade with

the colonization starting in the 16th century; the breakthrough for bulk and food transport and human migration from the late 19th century.

Which are then the distinctive elements of our contemporary globalization?

One is the increasingly widespread technical systems with more and more powerful methods for exploiting the earth, together with an urgent need to take responsibility for the consequences.

Another important trait of globalization is the information revolution, where people are participating in the creation of a common culture for the entire world. People are getting access to the internet and mobile phones all over the world, and there is a constantly ongoing discussion, which eventually will lead into a set of common values. This does not mean, however, that religions and ideologies will be obliterated. Probably, they will be strengthened. But as they will be forced to take position on

common global issues, such as environmental concerns, the status of women, democracy, distribution between the rich and the poor and (not least important for our future) the distribution of resources, they will converge.

Conclusions

To conclude, below are some long-term trajectories, which can be used as points of departure for discussing the future.

- Global agricultural systems.
- Path dependencies.
- Political systems (for example comparing the European diversified political system with the Chinese Empire—an entity for most of the last 2,500 years, at times containing 30 percent of the world population).
- Moral values: Human needs, not only as consumption but also as responsibility.

"Life can only be understood backwards, but it must be lived forward."
– Kirkegaard

Agricultural change and food security in China

ZHU LING

China is in continuous fast transition into industrialization and urbanization, and is striving to maintain sufficient food supply. The means are increasing agricultural productivity through developing the small farms, decreasing market regulations, and expanding on international food trade. Poverty reduction and social security programmes, together with better education for to-be farmers, are parts of the efforts.

Farm sizes and organizational structures

Chinese agriculture is based on what would internationally be called “mini farms”, many of which are only 0.2 hectares. These farms are neither low producing nor only self-sufficient. Most small and part-time farms sell at least some of the production, and their size is not a hindrance for modernization. On the contrary, China thrives on mechanizing the small farms through producing small tractors and machinery, and also through encouraging some farmers to specialize in machine service provision for others (figures 1 and 2).

In contrast to other countries, China has a large rural industry, which so far has absorbed 230 million rural labourers. Many villages and rural towns have transformed into urban areas. For example, the southeast coastal region of China used to be a rich agricultural area called “the home of rice and fish production”, exporting food products to the northern parts. As a consequence of rapid industrialization and in-migration of labourers, the area is now rather regarded as “the home of computers”. The area has become urbanized, and there is no land available for agricultural production. Instead, it is the north and northeast regions that have the highest commercialization rates for agricul-

Figure 1. Distribution of peasant farms by size of farmland in 2009 (15 mu = one hectare).

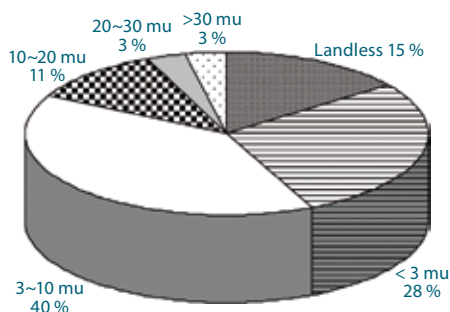
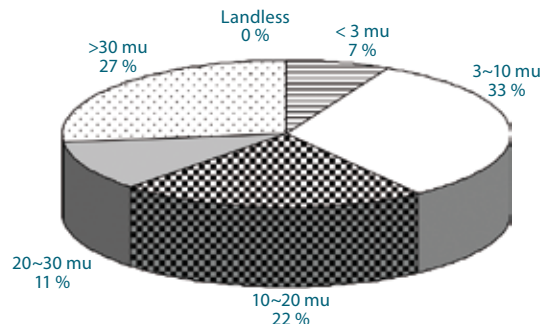


Figure 2. Distribution of land by size of peasant farms in 2009 (15 mu = one hectare).



Source: Data set of national sample survey on farmers, Research Centre of Rural Economy, the Ministry of Agriculture.

tural products. Due to long internal transport routes, the northern regions export food grain (mostly maize) and speciality products to Japan and South Korea, while the southern parts import rice from Vietnam and Thailand. Soybean, edible oils and grain (mainly maize) are imported, food grain (mostly maize) from Brazil, the United States and Canada.

The government intends to create an agricultural economy of scale. It has introduced a concept of “model companies”, stimulating the somewhat larger farms to specialize and increase their market orientation. Unfortunately, too often food companies keep controlling the farmers, for example through monopolizing processing and marketing. Since 2006, the government is also promoting farmer cooperatives. However, also in this case, policies supposed to give preferential treatment to small-scale farmers have been enjoyed forcefully by large farms and industrial companies. By merely adding the ending “-coop” to their names, they are taking advantage of the benefits. Therefore, there is still little change in power to the small-scale farmers’ advantage.

The food security situation

In China, poverty is most prevalent in rural areas, where a quarter of the population live on less than USD 1.25 per day, in comparison with urban areas, where only one and a half percent have to survive on this amount.

From 1990 to 2003, there was a recession on agricultural production. This was partly because of price reductions on grains and cereals, and also due to land lost in the Chinese industrialization.

Due to food security problems, the government took a range of policy decisions to stimulate food (in particular grain) production. This improved the food security situation quite dramatically with increasing yields and higher consumption. The government also introduced supplementary feeding programmes, especially targeting children in poor families. As a result, the percentage of low-weight children diminished to 5, and stunting to 13, in 2009 (table 1).

Table 1. Nutritional status of rural children under the age of 5, during 1990 to 2009.¹

Year	Percentage low-weight			Percentage stunting		
	Rural China	Non-poor areas	Poor areas	Rural China	Non-poor areas	Poor areas
1990	16.5	*	–	40.3	–	–
1995	14.1	–	–	40.8	–	–
1998	9.8	7.0	14.5	27.9	23.4	36.4
2000	10.3	7.4	15.8	25.3	19.1	36.9
2005	6.1	4.4	9.4	16.3	13.9	20.9
2008	5.1	3.9	7.3	13.7	10.9	18.9
2009	4.9	3.7	6.6	13.0	9.7	18.3

Source: The table is edited from Chen, C., and W. He, et al., 2010. *Nutrition during rapid economic development, and nutrition in China under the global economic crisis. Nutrition policy research reports prepared by Nutrition Monitoring Team of China Disease Prevention and Control Center (forthcoming).*

*) No data available.

1. Sample size: from 1990 to 1995 5,341 children; from 1998 to 2009 16,000 children. Of these, 60 percent were rural children. Samples during 2008 and 2009 only included rural children, because malnutrition was almost eliminated in the cities.

Predictions for 2020 and 2050

The Chinese population will soon peak, and by 2020 be down slightly to 1.38 billion people, with an urbanization rate of 54 percent. In 2050, the population is predicted to be 1.375 billion, of which 70 percent will live in urban areas. These people will eat more and better, increasing the demand on food considerably. It will cause heavier environmental pressure, increased scarcity of land and water resources, as well as a broader food supply gap.

In spite of the increasing domestic agricultural production, China will be short of major cereals in the future, most serious for maize. However, there will be a surplus of vegetables, fruits, poultry and aquatic products which may form a basis for trade (table 2). China is leaving the previous self-sufficiency strategy to become an exporter of surplus and import to add up and improve diversities of supplies.

Necessary policy improvements

China's food security situation has improved, but is still fragile. In order to strengthen food security at the macro and micro levels, and to counteract the broadening food supply gap, the Chinese government must continue to implement and improve its existing policies.

Policies to be strengthened

Stimulating public and private investment in agricultural research and development. Meanwhile, patent protection must be improved in order to attract private investors.

Improving the extension effectiveness. In comparison with other developing countries, China is doing quite well. The problem is the packaging. Most small-scale farmers have low income or are poor, and often they are women. The extension services should aim at such house-

Table 2. Self-sufficiency rate for major agricultural products, predictions for 2020 and 2050 (as percentage of full self-sufficiency).

	2004	2020	2030	2050
Three major cereals	103	93	90	85
Rice	101	102	104	104
Wheat	99	94	92	90
Maize	107	84	79	71
Soybean	49	41	39	38
Edible oil	67	62	60	58
Cotton	85	71	64	58
Sugar	91	85	79	75
Vegetables	101	104	105	106
Fruit	101	106	105	104
Pork	101	102	100	98
Beef	100	94	92	89
Mutton	99	94	92	89
Poultry	100	104	105	105
Milk & milk products	96	87	84	79
Aquatic products	102	103	104	104

Source: Cited from the Strategic Agricultural Development Research Panel of the Chinese Academy of Sciences (CAS). Roadmap for China's Agro-technology Development up till 2050, Science and Technology Press, Beijing, 2009.

holds with resource saving technologies and a gender perspective. Important topics are correct application of fertilizer and water saving techniques, to counteract the rapidly increasing negative consequences for the environment.

Expanding the coverage of social protection to also cover farmers. Currently, about 92 percent of the farmers and rural people are part of a cooperative health system, but the coverage is low and does not cater for heavier disease bur-



*Agricultural workers in Hui'an County, Fujian Province.
Photo: Zhu Ling.*

dens. Furthermore, farmers do not have old age security. Some of these social benefit systems have started in 2010 on experimental basis. There is now, for example, a monthly benefit of 55 Yuan (USD 6.80) for people over 60 years of age.

Introducing a two-track education system in rural schools, ensuring that also school children going to be engaged in agriculture get proper schooling, as well as increasing vocational training. Currently, all young people with education get absorbed into the industry.

Strengthening the international agricultural collaboration, and participating actively in agricultural trade. China has, for example, incurred some criticism for buying land in Africa. However, China's intentions are to help Africa raise its production as well as to increase food supply on international markets. This would meet the interest of both China and the world.

Policies to be reformed

Reforming the public grain procurement and reserve system. The government guarantees farmers a minimum price, in case of low prices. Until now, the system has catered only for rice and wheat, but needs to cover also other products. In addition, the system is quite inefficient, with only 14 percent of the subsidy benefiting the farmers and the remaining falling in the hands of the grain purchasing enterprises.

Reducing government regulations on foreign trade and eliminating trade and price distortions. However, this transition is difficult as food grains have always been on the political agenda and the government is reluctant to give up its control.

Empowering small-scale farmers to organize themselves and access equal rights. Smallholders' marginal social position is closely linked to, and is even causing, their economic plight. The only way to break this link is for smallholders to become organized, and to increase their political, economic and social influence. Empowerment of smallholders is therefore an essential condition for China's agriculture to develop in a sustainable way.

Conclusions

Despite higher agricultural production and a stabilizing population, China experiences decreased levels of self-sufficiency. Population growth and urbanization remain major challenges confronting China's food supply. To strengthen food security, both domestic agricultural production and international food trade must develop further.

African agriculture and change in the small farm sector

ASSEFA ADMASSIE

Historically, agriculture has been the foundation and key driver of economic growth, food and nutritional security and poverty alleviation in Africa. Currently, the sector employs more than 60 percent of the working population and contributes to more than 35 percent of the gross domestic product (GDP) in most African countries. The diversity of the continent makes it difficult to make broad generalizations. Small farm households across the continent show a high degree of diversification in terms of size, income levels, resource base, technology use and participation in international markets.

The majority of the African farmers are smallholders. Thirty million farms with less than two hectares of land account for more than 90 percent of the agricultural production. Especially in sub-Saharan Africa, these farms are marked by low levels of technological know-how and inefficient production systems. They use little or no fertilizer, improved seed and irrigation. There is also a general lack of infrastructure such as transport and telecommunication. Most farmers produce mainly for home consumption with limited surplus production, and the income is often supplemented by non-farm wages and small enterprises.

The importance of small farms in Africa

There is an ongoing debate regarding the importance of small farms in relation to large farms. Surveys of farms of different sizes in different countries frequently show that small farms produce more per hectare than large farms. Smallholders have detailed knowledge

of their soils, topography and drainage. The family workers are more motivated and hired workers provide higher quality labour. Thereby, all in all, many studies show that smallholders use their land more productively than farmers with larger holdings. Several studies show that investing in small-scale agriculture will lead to growth and help reducing poverty better than any other policy change, and help counteract rural-urban migration. This association between small farm development and poverty reduction seems to be stronger in Africa than elsewhere.

There are also arguments in favour of focusing on developing larger, more commercially viable farms. Several studies argue that commercial farm enterprises adopt new knowledge easier and are more competent in managing finance and exploiting trade and market opportunities.

Anyway, according to the World Development Report (2007), a 1 percent GDP growth originating in African agriculture increased the expenditures of the three poorest deciles at least

2.5 times as much as growth originating in the rest of the economy. Econometric estimates also show that for every 10 percent increase in farm production yields, there was a 7 percent reduction in poverty in Africa.

Changes in the small farm sector

Production increase

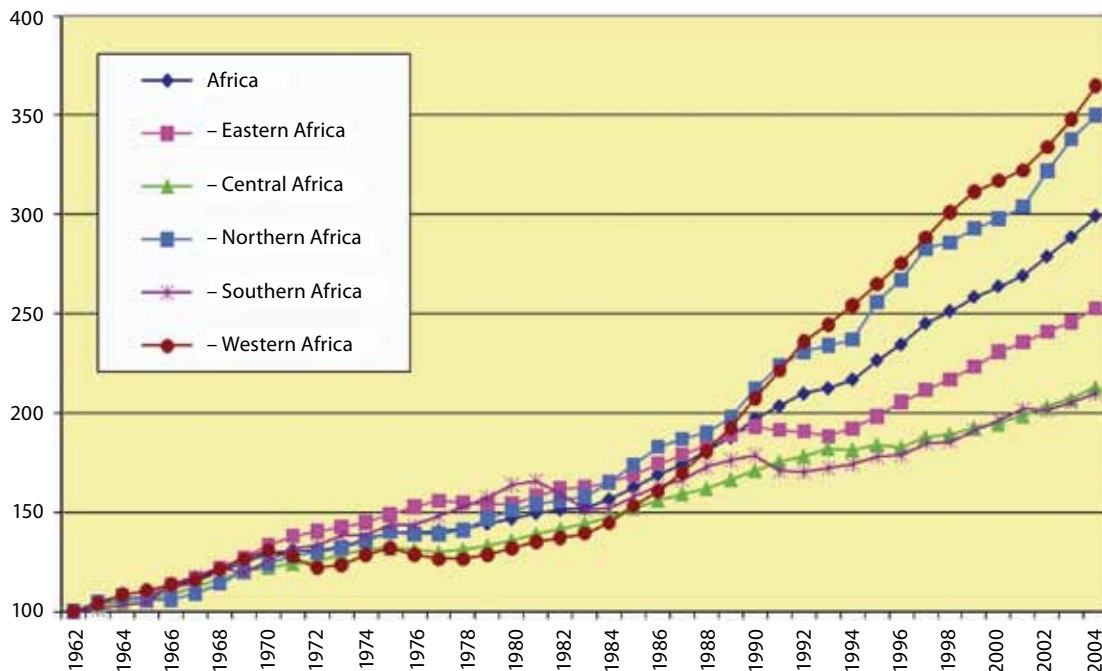
There has been a general increase in agricultural production in Africa, and much of this growth has taken place on small farms. It is, however, more attributed to the expansion in

cultivated area than yield increases. The production growth is also slower than the population growth, and the profitability of small farms have remained low in sub-Saharan Africa. There are large variations between regions, with northern and western Africa showing far better performance than the central, eastern and southern parts (figure 1).

Changing market conditions

Liberalization and globalization have made it harder for small-scale farmers to compete and integrate into the markets. They struggle to diversify into high-value products and to meet the

Figure 1. Relative growth of agricultural production in Africa and its regions, 1962 to 2004, as three-year moving averages relative to 1961/63.



Source: Steve Wiggins. 2009. *Can the smallholder model deliver poverty reduction and food security for a rapidly growing population in Africa?* Future Agricultures Consortium working paper No. 08.

quality and food safety requirements. If left to market forces, the winners on the liberalized agricultural markets will be the larger commercial farmers and organized farmer groups with access to outlets, infrastructure and credit. Unfortunately, most African smallholders are not that privileged.

African smallholders find themselves in the losing end of the global trading system. They have no influence over the rules governing the international markets; they face unfair competition on their domestic markets through subsidized imports; and protectionist policies in rich countries create unfair competition.

Diminishing support

Governments in Africa, as well as the international community, have moved away from supporting agriculture. Extension has been reduced and state agencies no longer provide direct marketing services to small-scale farmers. The removal of subsidies has made some key inputs, such as improved seed and fertilizer, prohibitively expensive for many small-scale farmers. The removal of price stabilization programmes has exposed farmers to more volatile farm gate prices. A shift from public to privately funded

research has refocused the programmes on the needs and opportunities of larger farmers.

Changes in production methods

Agricultural production methods have become more technologically intensive, often requiring higher capital inputs, mechanization and a higher degree of skills and education. Many high-value crops require up-front cash investment in seeds, fertilizer and pesticides. Yet, small-scale farmers in Africa are less able to obtain farm credit or inputs at comparable prices to large-scale farmers.

Declining farm sizes

A major trend in African agriculture is the steady decline in farm sizes (table 1). For the bottom quartile the farms are reaching micro-size, in many cases becoming smaller than 0.12 hectares per holding.

As the farm plots are shrinking, the habit of letting land lay fallow is increasingly being abandoned. Instead, it is continuously and intensively farmed for basic subsistence, without fertilizer leading to soil-mining, decreasing yields and aggravated poverty. Farmers' levels of skills and resources are not enough to devel-

Table 1. The ratio of cultivated land to agricultural population (hectares/person) in some countries, as ten-year averages from 1960/69 to 1990/99.

	1960–1969	1970–1979	1980–1989	1990–1999
Ethiopia	0.51	0.45	0.36	0.25
Kenya	0.46	0.35	0.28	0.23
Mozambique	0.39	0.37	0.30	0.25
Rwanda	0.22	0.21	0.20	0.16
Zambia	1.37	1.07	0.90	0.78
Zimbabwe	0.73	0.66	0.58	0.52

Source: Jayne et al., 2005.

op low-input and organic agriculture more systematically.

Another consequence is that farmers facing the shrinking size of land holdings have stopped redistributing land to their children, thereby creating a landless young generation. As a new phenomenon, for example in Ethiopia, the younger generation doesn't receive land and move into Addis Ababa and other towns to engage in petty trade, etc.

Environmental degradation and climate change

Soil erosion, soil degradation, desertification, deforestation, loss of biodiversity, depletion of groundwater aquifers and pollution of water-courses, are all evident in Africa. This will have severe consequences for small farms in Africa, resulting in losses to the rural societies and increasing costs of farming.

Climate change is having a pronounced impact, especially in the semi-arid lands and around the equator. Sub-Saharan Africa will need to make far-reaching adaptations in its farming systems to accommodate changed rainfall patterns and cropping seasons, by planting new crops and new varieties, and adopting new farming practices.

Conclusions

- Small farms play an important role in the growth and economic sustainability in Africa. They are efficient producers in the labour-surplus economies. They help ensuring a degree of food security in rural areas. Yet, most small farms are not seen as viable and hence are not prioritized for agricultural investment.
- Agricultural marketing chains are changing dramatically in ways that make it harder for small farmers in Africa to compete. The removal of price stabilization programmes has exposed farmers to greater price risks.
- Small-scale farmers are left without adequate access to credits and services. The removal of subsidies has made some key inputs, such as fertilizer, prohibitively expensive.
- More than 80 percent of Africa's farms are smaller than two hectares and are diminishing in size. Farm consolidation is increasingly recommended.
- Concerted efforts are urgently needed to create a more equitable and enabling economic environment for small farms in Africa. Market access, targeted agricultural research and extension, credit services, improved risk management strategies, tenure security, creation of rural non-farm opportunities, and the provision of basic infrastructure, etc. could all be helpful for African smallholders.

Food security and small-scale farming in India

MAHENDRA DEV

During the last twenty years, India has done well, considering indicators such as economic growth, exports, payment balance, resilience to external shocks and service sector growth. The annual economic growth has been 9 percent from 2004 to 2008. There is significant accumulation of foreign exchange, information technology, stock markets, etc.

However, there are serious concerns about agricultural growth and food security. The majority of all farms are small or marginal¹; 40 percent of the population live below the poverty line; and one-half are malnourished in one way or another. Therefore, the future of food security in India by 2020 and towards 2050 depends on the performance of small-scale and marginal farmers. This paper examines the policy reforms and institutional innovations needed for raising the incomes and increasing food security for small-scale and marginal farmers.

The small-scale farming in Indian agriculture

Problems and challenges

It is important to bear in mind that India is a large country with great variations between regions. There are 121 million agricultural holdings, of which 99 millions are considered small and marginal (2000/01 agricultural census). These account for more than 80 percent of

Table 1. The distribution of farms and cultivated land (in percent) by size of farmland, from 1960 to 2002.

Land class	Distribution of smallholdings			Distribution of operational area		
	1960–1961	1991–1992	2002–2003	1960–1961	1991–1992	2002–2003
Marginal (< 1 ha)	39	56	63	7	16	23
Small (1–2 ha)	23	19	18	12	19	21
Small and marginal	62	75	81	19	35	44
Semi-medium (2–4 ha)	20	14	12	21	24	22
Medium (4–10 ha)	14	9	6	31	26	22
Large (> 10 ha)	4	2	1	29	15	12
	100.0	100.0	100.0	100.0	100.0	100.0

Source: National sample survey, land holdings, 17th, 37th, 48th and 59th rounds, Central Statistical Organisation, Government of India

1. Small farms are 1 to 2 hectares; Marginal farms are smaller than 1 hectare.

the total farm households, cultivating 44 percent of the agricultural land (table 1).

There are many problems and challenges in agriculture, affecting especially small-scale and marginal farmers:

- The average farm size has diminished from 2.3 hectares in 1970/71 to 1.4 hectares in 2000/01.
- Yield levels are low and declining, mainly as an effect of deteriorating soil quality and water shortages.
- There is a technology fatigue. Although with large geographical variations, new varieties of major crops don't give higher yields.
- Governmental subsidies, targeting certain crops, hamper the diversification to other crops.
- Labour productivity in agriculture is low (the share of employment is 55 percent while the share of GDP is 18 percent).
- Growth factors, such as public and private investment, technology transfer, diversification and fertilizer use all have showed a slowdown in recent years. The growth rate in agriculture has declined from 3.5 percent of GDP per year during 1981 to 1997, to 2 percent per year during 1997 to 2005.
- Only 27 percent of all farmers have access to credit. For small-scale and marginal farmers this figure is merely 14 percent.

Many farmers are facing problems as agriculture is not remunerative. They feel vulnerable to land and water management problems, world commodity prices, credit arrangements, etc. As many as 45 percent want to leave agriculture altogether, but have nowhere to go; some feel desperate and as an effect, suicides among farmers are a problem in a few regions of the country.

Some dynamism in recent years

Despite the problems and challenges, there have been some positive signs in recent years:

- During the last few years, from 2004 to 2008, there has been a 4 percent growth in agriculture. There has been record high food grain production in 2008/09 and exports of cotton, rice and sugar.
- The BT cotton² has doubled cotton production in six years.
- Hybrid maize is a success.
- There is some increase in high-value agricultural production.
- Some rainfed regions show high growth in agriculture (9 percent per year in Gujarat, 2001–2009).
- India has comfortable buffer stocks of 60 million tons of grain.
- The Terms of trade for agriculture, based on GDP, has increased from 2004/05 and onwards, because of increasing agricultural prices.
- Although still low, the share of small and marginal farmers who has access to credit has increased from 4 percent in 1980, to 14 percent in 2005.
- Internet kiosks have expanded the access to the internet in rural areas, reaching farmers everywhere with local and global market prices, input prices, weather forecasts, farming practices and crop insurances. Also cell phone coverage is rapidly expanding all over rural India.

Progress on food security

Food availability. The projections show that by 2020 and 2050, India would be self sufficient in rice and wheat, but deficit in pulses and oilseed. There is need to increase the availability of fruits, vegetables, milk, meat and fish.

2. Genetically modified cotton, containing a gene from *Bacillus thuringiensis*, thereby producing a toxin against insect pests in cotton.

Access to food. Nearly 40 percent of the population live below the poverty line, and for them access to food is important.

Nutrition. As much as 45 percent of India's children suffer from malnutrition (which is double the figure for sub-Saharan Africa). The factors determining malnutrition are much wider than food availability and food access and include agricultural development, health, women empowerment, drinking water quality, sanitation, etc.

Goals for agricultural development

With the Indian 11th Five Year Plan (2007–2012), the country has incorporated the target of increasing agricultural production and improving food security, with special focus on reaching small-scale and marginal farmers. The plan states:

“The agricultural strategy must focus on the 85 percent of the farmers who are small, marginal and increasingly female, and who find it difficult to access inputs, credit and extension or to market their output.”

“While some of these farmers may ultimately exit from farming, the overwhelming majority will remain in the sector and the objective of inclusiveness requires that their needs are attended to.”

India has set up three main goals to reach food security:

1. Achieve 4 percent growth in agriculture and raised incomes, through increasing land and labour productivity, diversifying to high-value products and expanding rural non-farming employment.
2. The sharing of growth (equity), by focusing on small-scale and marginal farmers, wom-

en farmers and regions lagging behind (especially eastern India and rainfed areas).

3. Maintain sustainability in agriculture, by giving more attention to environmental concerns.

Policy changes needed to achieve these goals

To achieve these goals, there are several institutional and policy changes needed.

Improving land and water management.

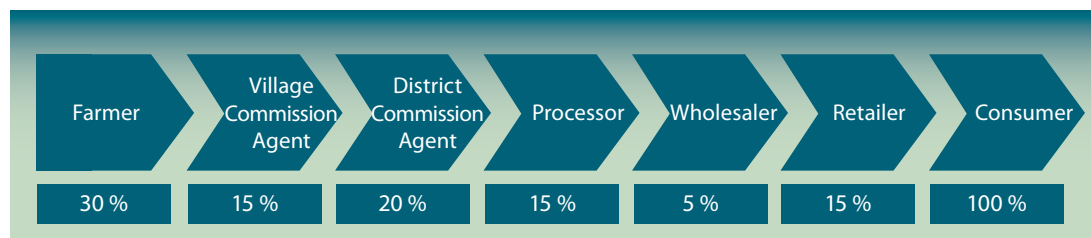
The decline in productivity and growth is much attributed to the deteriorating soil quality and water shortages. Therefore, improved land and water management should be the number one priority intervention.

Re-assessing the subsidies. India's public Foodgrains Management has three components: minimum support policy and procurement, buffer stocks and public distribution system. The government has fixed minimum support prices for 24 commodities, including rice and wheat. Because of its negative effects on the environment and that the system acts as a hindrance for diversifying agriculture, reconstruction of the programme is much needed.

Tenancy and land reforms. Although Chinese experience indicates that this is not necessarily the case, the small size of farms is seen as a problem. One major dilemma is that many farmers are unregistered tenants and tribal cultivators, thereby not getting access to institutional credits. Tenancy and other land reforms would help protect both the tenants and the land owners, including women farmers.

Integrating the National Rural Employment Guarantee Scheme into agricultural development programmes. This public works programme is providing hundred days of employment for members of rural households, with the

Figure 1. A typical Indian farmer-to-consumer value chain.



Source: Ravi Kumar, National Commodity and Derivatives Exchange Ltd.

aim of improving their purchasing power. The programme incurs criticism from farmers, for example for only offering work in peak agricultural season and disparities in conditions for agriculture and non-agriculture jobs. In general, the programme needs to be better integrated into agricultural development programmes.

Increasing public and private investments in agriculture. Currently, the investment level is 12 percent of agricultural GDP, but needs to increase to 16 percent with a larger focus on small farms.

Improving farmers' access to credit. Farmers access to credit must increase, and regional and farm size disparities for getting access must be rectified.

Promoting farmers' organizations. The farmer-to-consumer value chain is unfavourable for farmers, who often end up with a 30 percent share of consumer prices, while 50 percent would be more reasonable (figure 1). Through organizing farmers into cooperatives, contract marketing groups, self-help groups, etc., their bargaining power would increase.

Increasing diversification. Diversification of agricultural production to high-value products, such as vegetables, fruits, milk, eggs, fish and meat products is an opportunity for small-scale farmers to increase income and

employment. However, as policy support is still geared towards cereal crops, many farmers prefer growing rice and wheat as the risk is lower. Being perishable in nature, diversification needs improved infrastructure and supportive institutions.

Developing the rural non-farming sector. Poverty cannot be removed with 55 percent of the total workforce engaged in agriculture. Therefore, the rural non-farming sector must develop, and there are ample opportunities. As an example, India produces about 50 million tons of fruits and vegetables, but is only processing 2 percent of this, as compared to 23 percent in China, 78 percent in the Philippines and 83 percent in Malaysia.

Increasing education of the rural population. Education and skills are constraints in developing the agricultural and non-agricultural sectors. Currently, half of those engaged in agriculture are illiterate and only 5 percent has completed secondary school education. The National Commission for Enterprises in the Unorganized Sector is setting up special programmes targeting training and capacity building of small-scale and marginal farmers, and ensuring that the needs of small-scale farmers are adequately reflected in other programmes for livelihood security.

Lessons from China

China has gone through a rural structural transformation in the last three decades, and India can learn a lot from them. China has taken the lead in building up both physical and social infrastructure. Public investment, human development, rural non-farm employment and reforms in agriculture have led to growth and poverty reduction. The economic and institutional reforms have created space for a rural non-farming sector, which is one of the important factors responsible for rural poverty reduction in China.

India, on the other hand, has jumped from agriculture to services, but overlooked investing in the manufacturing sector. While employment in manufacturing in Malaysia is 50 percent, in Korea 62 percent and in China 31 percent, in India, it is only 12 percent.

Conclusions

- Small-scale farmers are remaining an important part of Indian agriculture for years to remain. Numerous institutional and policy reforms are needed for increasing production and improving food security, reflecting the differences between the earlier Green Revolution and this “Second Green Revolution”.
- There is need for a massive increase in expenditures on agriculture and rural infrastructure by simultaneously improving the delivery systems.
- Improvements in land and water management should be the number one priority!
- It is going to be a big challenge for India to reduce malnutrition in future.
- The Elephant (India) can learn from the Dragon (China) on rural transformation, particularly rural industrialization.

Brazilian agriculture, its productivity and change

ELISIO CONTINI

Before 1970, Brazilian agriculture was characterized by low production, food supply crises, rural poverty, lack of specific knowledge on tropical agriculture and lack of institutional support such as research, education, markets and infrastructure. Agricultural production was concentrated to the south and southeast.

At that time, Brazil decided to move from a traditional agricultural economy, to one based on science and technology, and to ensure food security for the Brazilian society. The challenges were to increase agricultural production to supply the growing urban population with affordable food, and to diversify agricultural exports allowing for imports of capital goods for the rising national industry.

Drivers of the Brazilian agriculture development

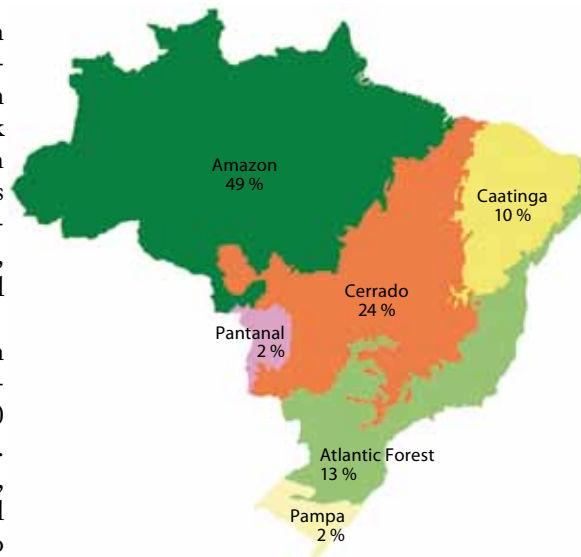
In 1973, the Brazilian Agricultural Research Corporation, Embrapa, was created with generous resources to lead the expansion into modern agriculture. Today, Embrapa has a wide network for research and development with 45 research centres and services units, 3 virtual laboratories abroad and offices for technology transfer including support to developing countries (Africa, Central America and Venezuela). Also rural extension has been sufficiently supported.

Many small-scale farmers in southern Brazil, with 10 to 30 hectare farms, were offered to sell their land and buy up to 5,000 hectares to start larger farms in central Brazil. These farmers were supported with rural credit, extension and research. The main agricultural expansion has taken place within the Cerrado biome (figure 1).

Several key factors contributed to the development of the Brazilian agriculture:

- Government commitment.
- Entrepreneurship of farmers.
- Availability of basic infrastructure.
- Favourable climatic conditions.
- Large extension of arable land.
- A landscape suitable for mechanization.
- Good physical properties of the soils.

Figure 1. The Brazilian biomes, and their proportion of the total land area.



Source: *Ministério da Agricultura, Pecuária e Abastecimento Biomes, Ministério do Meio Ambiente, 2006.*

- Availability of mineral resources (limestone and phosphate).
- Science-based tropical agriculture.

Without the agribusiness, there could have been many crises in the Brazilian financial sector. Since 1994, Brazil has control over its inflation, and after 2000, there is a flexible exchange rate. The only problem is that the interest rate is too high.

Brazilian agriculture: grains, meat and bioenergy

The Brazilian agricultural production has grown tremendously in 30 years:

Grains: The five most important grains are rice, maize, beans, soybean and wheat. From 1976/77 to 2009/10, the acreage increased from 37 to 47 million hectares and the production has increased from 50 million tons in 1976/77 to 150 million tons in 2009/10.

Meat: This includes mainly beef, poultry and pork. Poultry has increased tenfold, from 1 million tons in 1978/79 to 11 millions in 2008/09. Beef has increased from 2 million tons carcass equivalents in 1978/79 to 8 million tons in 2008/09. Pork has increased from 1 million tons carcass equivalents in 1978/79 to 3 million tons in 2008/09. Milk, which is mainly produced for the domestic market, has doubled in the last 20 years.

Sugar and ethanol: Eight million hectares are devoted to sugarcane. The sugarcane production has increased from 90 million tons in 1975/76 to 700 million tons in 2009/10. Sugar production has increased from 7 to 30 million tons, and ethanol production from 600 million litres in 1975/76 to 26,000 million litres in 2009/10.

As much as 18 percent of all energy used is derived from sugarcane as the second energy

source after petroleum products. The third one is hydroelectricity. With 47 percent of all energy originating from renewable sources, Brazil is the world leader on usage of sustainable energy. Over 90 percent of all light-weight cars sold in 2009 are flex-fuel vehicles, using gasoline, ethanol or both as a mixture.

Brazilian domestic market and export

In June 2009, the total gross value of agricultural production was USD 170 billion. Of this, beef has the largest share with 21 percent, thereafter soybean with 16 percent and sugarcane with 10 percent share of the gross value of production (figure 2). Most of the agricultural production is for the domestic market, with ethanol, beef and maize as major products. Sugar, coffee and soybean, on the other hand, are mainly exported (figure 3). The total value of the agricultural export in 2009 was USD 65 billion, and the main products exported were soybean, meat, sugar and ethanol. The main export destinations are the European Union (30 percent), China (14 percent and growing) and the United States (7 percent).

Currently, Brazil is the number one producer and exporter of sugar, coffee and orange juice; second producer of soybean, beef, tobacco and ethanol; the third one of broiler and the fourth of maize and pork (table 1). In the coming 40 years, Brazil will continue diversifying into other products not yet thought of.

The food basket real price index in Brazil was reduced with 50 percent from 1975 to 2010. This is important as 85 percent of the Brazilian population live in the urban areas. In the process of expanding the agricultural production, the poor in rural areas were moved into the cities, and it is important to cater for their food security.

Figure 2. Gross value of production, as shares of the total gross value of agricultural production, in 2009.
Total value: USD 170 billion.

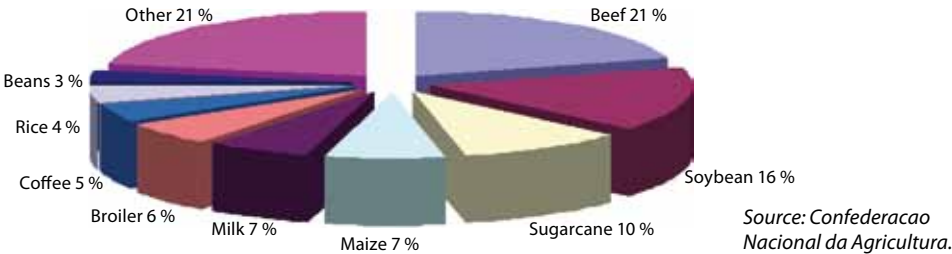


Figure 3. Domestic consumption and exports, 2009.

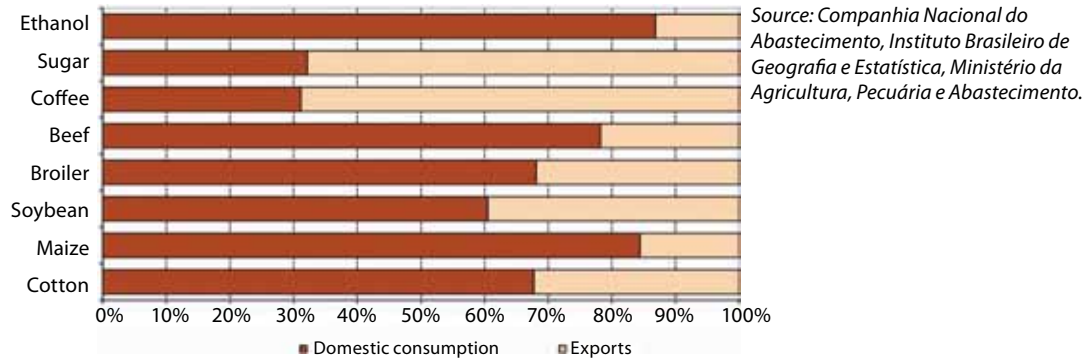


Table 1. Brazilian agribusiness production and exports (world ranking and export value).

Main products	Production	Exports	Number of markets	Exports
				USD billion
Sugar	1 st	1 st	124	8.4
Coffee	1 st	1 st	81	3.7
Orange juice	1 st	1 st	75	1.6
Soybean	2 nd	2 nd	46	11.4
Beef	2 nd	1 st	142	4.1
Tobacco	2 nd	1 st	100	3.0
Ethanol	2 nd	1 st	48	1.3
Broiler	3 rd	1 st	146	5.3
Maize	4 th	3 rd	49	1.3
Pork	4 th	4 th	81	1.2

Source: United States Department of Agriculture; Ministry of Agriculture, Brazil.

Agricultural conservation in practice

Brazil is sometimes criticized for encroaching into the Amazon forest with sugarcane production. However, around 87 percent of all sugarcane is produced in the (southeastern) Sao Paulo Region and the remaining in the Northeast Coastal Region. Four percent of the arable land is used for sugarcane, and of this only half is processed to ethanol. Brazil produces sugar for export and ethanol for domestic fuel.

Certain land is protected from agriculture. The Federal Government has implemented regulations that prohibit sugarcane plantation in sensitive biomes such as the Amazon forest, the Pantanal wetlands and on native vegetation (such as cerrado and grasslands). On the other hand the government has authorized 65 million hectares for sugarcane expansion, which is equivalent to 7.5 percent of the Brazilian territory (currently less than 1 percent is used for sugarcane).

Thanks to the soybean plants' ability to nitrogen-fixation, no farmers use nitrogen fertilizer in that production. In addition to saving the environment, it also saves USD 5 billion worth of fertilizer for the farmers.

Brazil has set up some targets for increasing sustainability:

- Improve soil quality (chemical, physical and biological).
- Control weed and disrupt insect and disease cycles.
- Use highly productive systems ("sparing land technology") to increase food, feed and biofuel production.
- Improve economic performance and reduce business risks.
- Training and education of farmers.

To increase efficiency and save land area, Embrapa has introduced a three-crop system in the Cerrado area, which farmers are beginning to adopt:

- October to February: soybean production.
- March to June: production of maize or sorghum.
- July to September: pasture for beef.

Brazil is also protecting 115 million hectares, including Indian areas and protected forests. These areas are mainly in the Amazonas biome, and are more than twice the area Brazil uses for agricultural production.

Conclusions

- Good policies (macro and agricultural) with adequate development programmes are important. Three policy instruments were the key for modernizing the Brazilian agriculture: financial credit for farmers, investment in science and technology and rural extension.
- People with experience, skills and knowledge make good farmers.
- Brazil is a major player for increasing food security worldwide with clear opportunities for accommodating food, feed, fibre and biofuel expansion in a sustainable way.
- Widespread use of sparing-land technologies and low-carbon agriculture through integrated crop-livestock systems need to be developed further.
- Basic infrastructure such as roads and ports needs further improvement.
- Distortions in the world agricultural markets negatively contribute to food security and farmers income in developing and poor countries.

Russian agriculture and its structural change

EUGENIA SEROVA

In general, the 27 post communist countries have now completed the transition from communism to market economy. These reforms took different paths and the countries have landed with different agricultural systems. The divergences are not the result of incomplete transition but caused by economic, institutional, geo-climatic and other reasons.

This paper discusses the development of agriculture in Russia, and in some cases includes also Kazakhstan and Ukraine, which have similar agricultural systems. The most remarkable change is the emergence of the extremely large-scale agroholdings and their impact on the agricultural sector as a whole.

State of the art

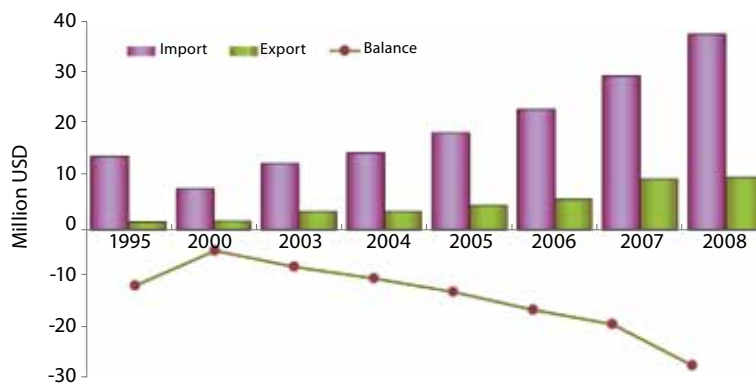
From 1991, when the reforms in Russia began, there was a long-lasting stagnation in the agricultural sector. This stagnation was halted by the devaluation of the national currency during the global financial crisis of 1998. The four-fold Rouble (RUB) devaluation for some time protected the domestic markets from imports, and thereby opened a window of opportunities for the domestic producers. The financial crisis

made small-scale and short-life investments most profitable; one of the first sectors to meet these criteria was the food industry, which pulled primary agriculture and agricultural manufacturing industry along.

The recovery growth has revealed which of Russia's agri-food industry sectors have comparative advantages. It is now obvious that Russia will continue as a big world exporter of grain and sunflower seeds, maintain self-sufficiency in milk, pork, poultry, potato and vegetable production and remain an importer of beef.

The territory, which is today called Russia, has always in history been a net importer of food. From 1998 to the year 2000, the negative net trade balance notably shrunk, but has since then grown again (figure 1).

Figure 1. Value of food and agricultural import and export, million USD.



Source: Rosstat.

The new structure

Almost everywhere in the post Soviet Union countries, there are three categories of producers:

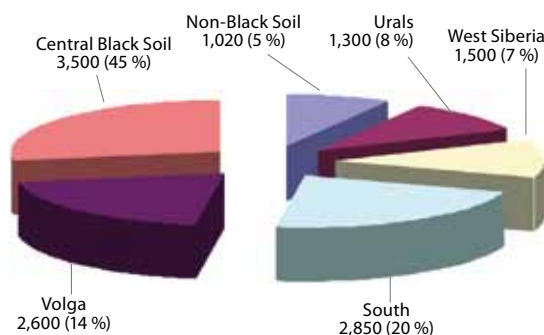
Large-scale enterprises, mainly successors of former kolkhozy and sovkhozy. The category includes large farms of around 12,000 hectares, with about 600 heads of cattle.

Family farms, which are supposed to be run by families, with typically 100 hectares land and 30 heads of cattle.

Household plots, where the rural population has a small piece of land, about half a hectare, and three heads of cattle for subsistence production.

Then from 1998 and onwards, in Russia as well as in Kazakhstan and Ukraine, a new phenomenon has appeared, called *agroholdings*. These are very large farm operations established with capital from outside the primary sector, often originating from the most profitable sectors of Russia's economy such as energy, finance or metallurgy. Close to 13 million hectares are cultivated by agroholdings, dispersed over various okrugs, or regions (figure 2).

Figure 2. Area farmed by agroholdings in each okrug (region), in thousand hectares, and their share of the agricultural land in each area.



Source: Institute for Agricultural Market Studies (IKAR).

The size of these agroholdings can be up to 300,000 hectares. The organization and management structure differ tremendously from company to company. Sometimes they are organized with participation or under the control of regional or local administrations; although in most cases they are purely private. Land tenure varies: a company can own huge areas, although most often they rent land shares.

What distinguishes these new operations—compared with the traditional types of farms—is not predominantly the scale of operation but the notable investment inflow to the primary sector, together with a new type of management, new technologies, strict commercialization of the business and an aggressive behaviour on the markets. The agroholding managers have enough means to maintain quality control and comply with international standard requirements, which together with the scale of production give market power and better access to markets inside the country and abroad. Because of the ability to produce collateral have they good access to financial resources.

These agroholdings are bringing a lot of change to Russia's agriculture and agribusiness. The total consequences of their emergence are still not clear. Without doubt they have brought capital to the sector, something it was deprived of for almost a decade. The investments allow modernization of the primary agricultural sector as well as the downstream sectors and market infrastructure. The agroholdings train personnel (even through sending people to the main educational centres and abroad) and bring new managerial skills.

However, there is also a number of disquieting sides of the new developments. The agroholdings follow a capital-intensive pattern of modernization, increasing labour productivity and correspondingly decreasing the demand for labour, something that causes certain un-

rest within the rural population. Then, faced with the too costly control over the workers, the agroholdings tend to substitute them with machinery (wide-cut machinery, automatic equipment, space technologies, etc), which leads to even higher unemployment in the rural areas. Another visible problem is over-investment. The (usually external) investors are used to looking for the world's best practice and technology for their enterprises. However, these technologies are introduced into an economical environment where labour and land are cheap. Furthermore, the agroholdings are usually established by influential capitalists with great lobbying power. They have started to request protectionist measures from Russia's government, which is one of the reasons for the growing protectionism in the agri-food sector.

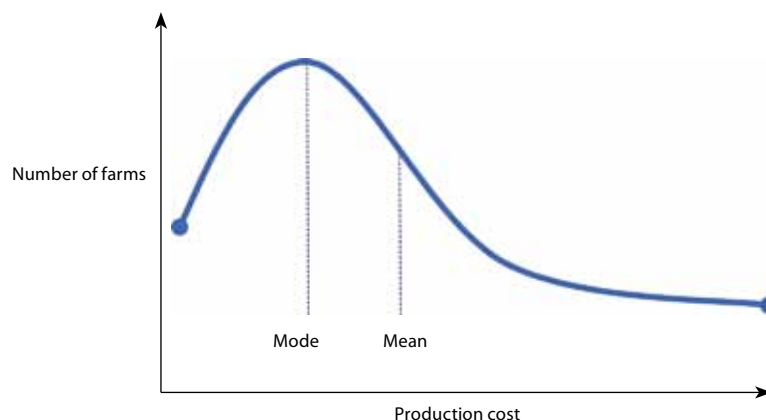
Factors of this new structure

Then, why was this agricultural structure, with these extremely large agroholdings, formed in Russia during the transition period? There are several reasons for that:

1. The Soviet Union left an infrastructure tailored for large-scale agricultural enterprises. There was neither time nor resources to adjust the infrastructure and instead this new type of agricultural units arose.
2. A consequence of the previous kolkhoz/sovkhoz system was the formation of partial workers: agricultural labourers that could only perform one or two working functions, which is totally insufficient for running an own farm.
3. Years of official collectivism have spoiled people's ability for cooperation and collective action. This has led to a situation where non-cooperating small-scale producers fail in competition with the large-scale operators for access to markets, resources and infrastructure.
4. Lack of managerial skills caused the emergence of an agricultural structure based on the large-scale operators.

All above mentioned farm types are extremely polarized in terms of performance (figure 3). The mode¹ farms are modern and effi-

Figure 3. Producers' distribution by cost of production.



1. Mode or modal value is the number which appears most often.

cient with high productivity. The mean farms and those with even higher production costs are normally bad performing units. However, most of them have remained in operation. The maintenance of these low-performing farms during already 20 years has been determined by the lack of sound policies which could have provided the rural population with decent sources of non-agricultural incomes. However, the government still prefers to subsidize these marginal producers in order to support the population in corresponding rural areas in spite of the marginal level of income.

Conclusions

- The excessive polarization of agricultural producers will cease and the most marginal farms will disappear.
- Subsistence farming will shrink together with economic growth and social stabilization, but small-scale commercial production will remain.
- Agricultural divisions of multi-sector companies will be separated into specific agribusiness companies. These agroholdings will invest in research and development and therefore lead the modernization of agriculture.
- Agroholdings are effective sector lobbyists, increasing the state interventions and support. They will expand in capital intensive agricultural technologies, in growth of managerial potential and labour skills, and land tenure and rural development.

An attempt at synthesis

ROBERT THOMPSON

There are three dimensions of food security: at the household level, national level and global food security.

Food security at household level

At the household level, food insecurity is caused by poverty. Of the 1.1 billion people who live on less than one dollar per day, 70 percent reside in rural areas and most of them depend on farming for their livelihoods. If we want to solve the hunger problem, we have to solve the poverty problem, and poverty is most prevalent in rural areas on small farms. Although urban poverty is also a problem, the millennium development goal of reducing poverty to half before 2015 is not attainable unless more is done to reduce poverty in rural areas.

There are really only five ways to increase farm family income:

- Increase productivity of present crops.
- Get access to more land.
- Change to higher value (per hectare) crops.
- One or more members of the household get non-farm income.
- Leave agriculture altogether by migrating to urban areas or attaining full-time non-farming jobs within commuting distance.

Only the private sector can create the jobs necessary to solve the poverty problem, but it needs a positive investment climate. Urban areas are growing very fast, and no one wishes for all of the rural poor to migrate to urban areas. Therefore, creating non-farm rural employment

within commuting distance from farms is essential.

Food security at national level

Although governments should be careful not to interfere directly with trade or production, governments have important roles in supporting economic development. Some essential tasks for governments are:

- Creating a positive investment climate, through providing legal environment and public policies, such as creating macroeconomic and political stability; enforcing the rule of law; enforcing the recognition and respect of contractual arrangements; enforcing the recognition of property rights, including ease of registration and transfer of land ownership.
- Investing in people, through universal primary school education and health care. Education helps in reducing the fragmentation of farms by facilitating outmigration from farming, which is much easier between generations than within one generation.
- Facilitating establishment of rural infrastructure, such as roads, transportation, telecommunication and electricity supply.
- Investing in agricultural research.
- Enforcing anti-monopoly laws.
- Enforcing consumer protection, including both food safety and farming input quality (such as honest weights and measures of farming inputs and correct content of fertilizers).

- Collecting and disseminating statistics.
- Reducing trade regulations. It is important to keep in mind that national food security does not mean self-sufficiency. Some countries in the world will be net exporters and others will be net buyers of food. However, to import food a country also has to sell goods on which it has a comparative advantage. Therefore, easing up trade regulations is of uttermost importance.
- Reducing the risk of farming. Farming is a risky business, but what would be the appropriate role of governments? Supporting farm prices is a weak poverty reduction policy, as this primarily benefits those producing most, not the most needy, and that it over time inflates land values and thereby counteracts poverty reduction. This issue does not have a clear answer and would certainly be worth more discussion!

Global food security

At global level, the big question is how we are going to have enough food to support the human population.

From 2010 to 2050, the world population is projected to increase 38 percent, from 6.9 to 9.5 billion people (table 1). The largest increase both in share and total number will take place in sub-Saharan Africa. The world population's food demand could rise an additional 50 percent from successful broad-based economic growth that significantly reduces poverty in low income countries. In addition to the growing demand for food, there will also be growing demand for things made out of wood, such as paper, furniture and building materials in the low income countries, and for environmental amenities, preservation of forested areas and bio-fuels in the rich countries. If the world's farmers need to double agricultural production to feed the growing world population and satisfy these other demands, there will be keen competition for arable land.

Arable land is a major constraint. South Asia, East Asia and the Pacific contain 52 percent of the world population, while there is only 29 percent of the arable land (figures 1 and 2). Africa on the other hand has nearly the same share of population as of arable land. Europe and the other Organisation for Economic Co-

Table 1. Projected population growth from 2010 to 2050, in millions and percent.

Region	2010	2050	Change	Percent
The world	6,892	9,485	2,593	38
High income countries	1,237	1,326	89	7
Low income countries	5,656	8,159	2,503	44
East and Southeast Asia	2,168	2,425	257	12
South and Central Asia	1,755	2,620	865	49
Sub-Saharan Africa	865	1,831	966	112
Latin America and the Caribbean	585	729	144	25
North Africa and western Asia	444	708	264	59

Source: Population Reference Bureau. 2010 World Population Data Sheet, based on the United Nations Population Office and the United States Census Bureau analyses.

Figure 1. Distribution of arable land.

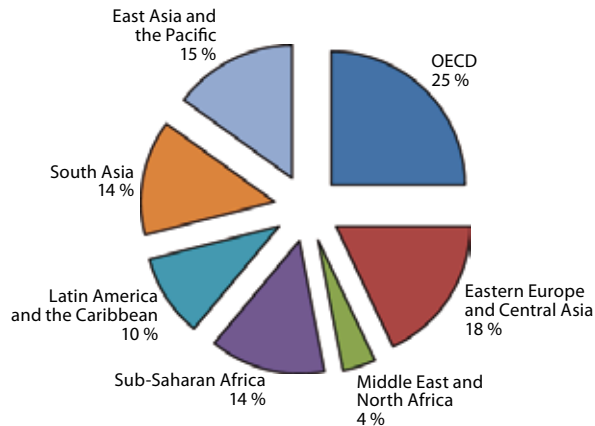
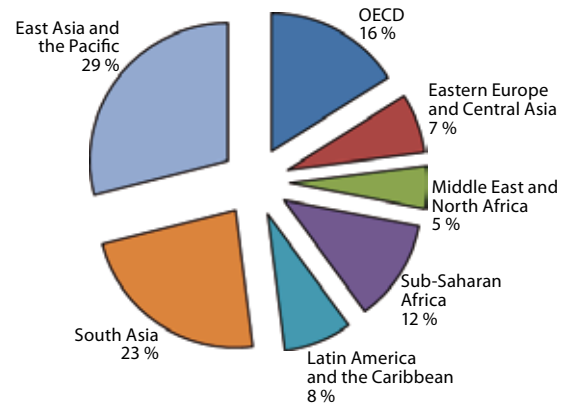


Figure 2. Distribution of world population.



Source: World Development Indicators database 2010. World Bank.

operation and Development (OECD) countries have considerably more of the world's arable land than population, and are also net exporters of foodstuffs.

It is estimated that there is only around 12 percent more arable land available in the world that is not presently forested or subject to erosion or desertification, and arable land is being lost every year as a result of degradation and urbanization. The only environmentally sustainable alternative is to double the average productivity on the fertile non-erodible soils already in crop production. The largest areas of arable land that could be brought into production are in South America and sub-Saharan Africa. A critical question is: what would it take for sub-Saharan Africa to make the contribution to world food production it has the potential for? In an environmentally sustainable manner.

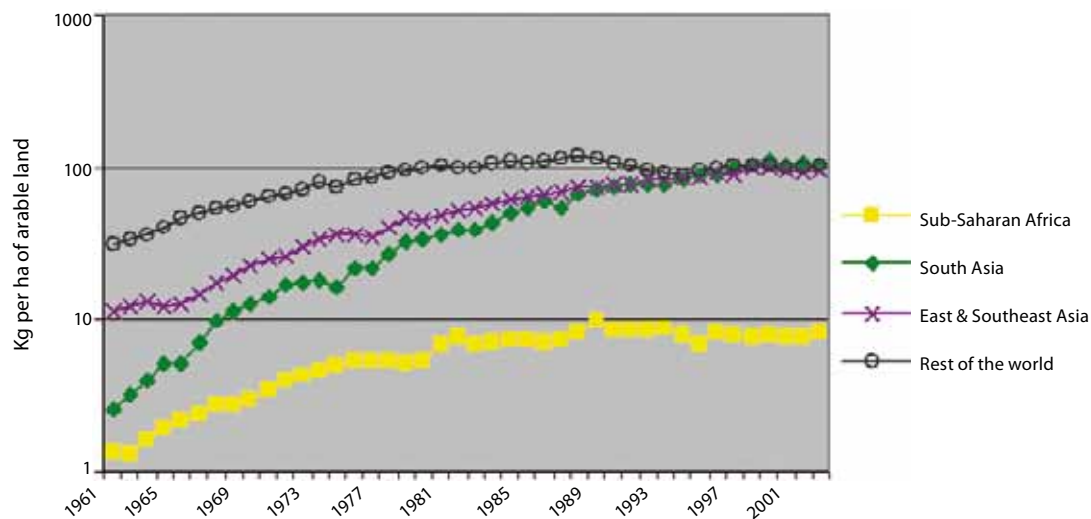
Fertilizer rates. The application of NPK¹ fertilizer increased significantly between 1960 and 2000 in most parts of the world. Only Africa is still using extremely low rates of fertilizer (figure 3).

Water. Water availability is a growing constraint. Farmers are today the largest users and the largest wasters of fresh water, especially where it is supplied at no cost, signalling that it is more abundant than in reality. With the rapid urbanization, more fresh water will be needed in urban areas, and cities are likely to outbid agriculture for available water.

Climate change. There will certainly be required adaptation to global warming. We know that increases in temperature will affect large parts of the world; however there is much less consensus about how rainfall patterns will shift in different parts of the world. Nevertheless, we

1. NPK: The macro nutrients nitrogen, phosphorus and potassium.

Figure 3. Fertilizer use (N + P + K) in some parts of the world 1961–2002.



Source: Faostat. United Nations Food and Agricultural Organization.

will need adaptive plant and animal breeding to sustain even present productivity levels. The mix of crops grown in some areas of the world will need to change, and some areas will have to rely more on international trade. We need research to make presently unusable soils productive, increase the genetic potential of crops and animals, and reduce losses from pests and post-harvest.

Long-run prospects

Since Malthus, many prophets of doom have argued that population growth will increase food demand faster than agricultural production can grow. So far, public and private sector investment in agricultural research have increased productivity faster than demand growth, with resulting 150 year downward trend in real price of grains.

However, agricultural research has been off the global agenda for close to three decades now. It has been crowded out by new issues like environment and HIV/AIDS. Rural areas of low income countries lack political clout relative to urban areas, and agriculture has been seen as a riskier area for development projects. Moreover, transnational non-governmental organizations have labelled modern agriculture as part of the problem rather than part of the solution. As a result there was an immense drop in resources invested in agricultural development in foreign aid programmes, World Bank lending, and low income countries' government budgets.

There has been increasing concerns about future global food security since agricultural prices spiked in 2008. This appears to be starting to bring agriculture back onto the global development agenda, with a recommitment to this area in the World Bank and the United

States Agency for International Development (USAID), and hopefully also in the Swedish International Development Cooperation Agency (Sida). Some developing countries have also started to increase their investments in the agricultural sector.

What do developing countries need from the high-income world? They certainly need a more open trading environment that can stimulate faster economic growth. They need market

access for goods in which they have comparative advantages. They need foreign aid and international lending for investment in necessary infrastructure, technology, know-how and facilitation of adjustment, and they certainly need foreign direct investment. If the governments of these countries provide a positive investment climate, both local capital and international capital will flow into these regions.

Panel discussion

The panel was composed of all previous speakers, except Dr. Zhu Ling who had left. In addition, Professor Ewa Rabinowicz participated, giving the European perspective. The discussion was led by Professor Robert Thompson.

Would you like to start by adding some perspective from Europe and Sweden?

Ewa Rabinowicz: The farmers in Europe are becoming bigger and fewer, with a rather small number of farms accounting for the bulk of production. There are three implications of that:

1. The need to create jobs in rural regions for those quitting agriculture. Farm tourism and other enterprises basing their activities on natural resources are cropping up, as well as green care and social farming.
2. The future of the marginal lands. Productive farms will concentrate and others will become marginal. The European Union's Common Agricultural Policy offers some funding for the protection of biodiversity, however, it is not enough to cater for all marginal land.
3. The comparative advantage of European and Swedish agriculture. Europe is probably better on quality than bulk production, and Sweden should probably have comparative advantages on highly processed products. The farmers are well-educated and the regulatory systems are well-functioning. If the Europeans could change their attitude towards biotechnology, the continent would be suitable for such production.

There is a clear distinction between differentiated products and commodities. To what extent can differentiated products generate enough income to sustain small and medium size farms?

Eugenia Serova: There can be different types of maize: maize for salad and maize for feed. Milk can be produced in bulk or for specific consumers' requests. In general, large farms can produce bulk providing food security for the nation, while with increasing wealth, consumers' demand for specific qualities increases. This is where I see small-scale producers having a niche and a future.

What would it take to generate enough income to lift the African smallholders out of their poverty?

Assefa Admassie: Africa has unused arable land that could be brought into cultivation. The current low agricultural productivity could increase considerably. Water is a constraint, but if well managed and equally shared it would go a lot further. Africa has high potential for agriculture and could even contribute to the reduction of global poverty.

However, Africa is destitute. It would not be possible to pull people out of poverty without welfare actions. It would require some kind of a

transition mechanism, at least in the short run.

With good visionary leadership, Africa could make a difference. Fair trade and market access, both within Africa and in other countries is critical. Agricultural research and extension need strengthening, and should focus more on traditional tropical crops (for example root crops) that are important for food security among rural people.

In India, there is an immense number of low-income smallholder farmers, and landless world residents. While China's population is expected to peak before 2040, India's population appears to continue increasing and be 300 million more than China's by the middle of the century. How will India manage to feed its population in forty years from now? Can India be self-sufficient?

Mahendra Dev: Predictions show that India can be self-sufficient on food grains like rice and wheat. Pulses, oil seeds and other foods, as well as high-value products will have to be imported. Hopefully, India can learn from China how to shift people from agricultural to rural non-agricultural occupation, and how to encourage farmers to diversify production.

Two important factors are needed to reduce poverty:

1. Policies outside agriculture, such as human development, health and education. The creation of rural non-farming employment is of major importance, together with access to credit and technology, and supportive institutions.
2. Agricultural policies, basically providing incentives (support price policy, reduced restrictions on export, etc.), infrastructure and institutions (for marketing, contract farming, farmer groups, technology transfer, etc.).

Investments, both public and private, are essential for development. For example, when the public sector invested in electricity, the private sector invested in wells.

In the late seventies, while the high-income countries were cutting their public support to agricultural research, Brazil went the other direction. The Brazilian government decided that supporting their agricultural research was the way forward, and began investing massively. What are your recommendations for success? And what is Embrapa doing to help other developing countries?

Elisio Contini: In the 1960s, the Brazilian government decided to create an agricultural research institute, anew, and to support agriculture on a large scale. With public money, but managed as a private entity. When starting up, Embrapa received support from many institutions, and had two guiding principles:

1. Concentration of the scientists for each subject in one research station, to get a critical mass to make real research.
2. Education and training: A lot of money was spent on training, financed by the World Bank and the Inter-American Development Bank (IDB). Three thousand Embrapa researchers were trained. The first few years, the United States, European universities and researchers from other institutions helped. All work was long term.

The advice for other countries is to invest in training and to concentrate scientists in one place!

In Africa, the Brazilian government give assistance to Portuguese speaking countries. Together with Japan and the United States, Embrapa is enhancing the capacity of research

at the Institute of Agricultural Research of Mozambique. Brazil coordinates work in Ghana, Mali and Senegal, in Mali on cotton production and in Senegal on rice.

What about the magnitude of post-harvest losses? Can they be used for feed or any other purposes, or are they just lost?

Joachim von Braun: For staple foods, the post-harvest losses are in the order of 5 to 10 percent; in many cases these are physical losses to rats and insects. The large and unavoidable losses in fruit and vegetable production are often in the order of 30 percent. It would be a waste of economic resources trying to bring them to zero.

There is a striking difference between the rich and the poor world. The rich world wastes at the retail, household and restaurant levels, whereas the poor world wastes largely pre-harvest, probably because of lack of pest control. The poor world wastes very little post-harvest.

When a government is trying to address national food security, how relevant is national food self-sufficiency as a policy objective? And if it is a policy objective, should we encourage it or is it inimical to food security?

Mahendra Dev: From the Indian point of view, the national self-sufficiency of grain is very important. India may import 2 or 3 million tons, but would not want to depend on importing 10 million tons. The policy of national self-sufficiency of rice and wheat will remain, at least for the next decade.

Elisio Contini: Brazil imports 90 percent of its fertilizer. The policy for wheat production is to produce 50 percent and import 50 percent. Currently, there are problems in China, India

and Africa, but in forty years, all parts of the world will have higher production efficiency and the policies will probably not aim at protecting the internal markets too much. In the future, I expect efficiency to dominate the markets.

Please react and add on what you have heard yesterday and from this discussion.

Joachim von Braun: The great diversity of farms has been clarified in the workshop. This diversity calls for diverse policies to reach the most promising futures of people who earn their living from farming and for consumers, for people in villages and in cities. We can see opportunities in the diversity, but in parts of the world the current situation of farming entails suffering. The transformation of farming in those areas needs to accelerate, with technology and with education and with jobs outside agriculture. There are also optimistic conclusions emerging from the workshop: agriculture has a central position in an environment- and climate-friendly “green growth” strategy.

Despite of the great diversity of farming around the world, a common international framework is needed, especially for trade and for knowledge sharing, such as agricultural science policy. This requires much better global governance arrangements for the public goods that serve farming and that are served by farming, such as ecosystems services.

The workshop has highlighted that we are not living in a world of food-plenty! Healthy diets are unaffordable for many, especially the poor who live on farms. We concluded that accelerating agricultural development is essential for overcoming the current food crisis, as indicated by the large number of hungry people. The food crisis is not just a matter of sudden and large price changes, as important as these are.

For instance, when a child at an early age has a food deficiency shock, its health and work potentials are ruined for life. Acute suffering from under-nutrition thus perpetuates the crisis. The important role of agriculture for public health cannot be overemphasized, but it remains overlooked by policy. Working for better futures of farms is a central part of the solution to the food and nutrition crisis.

Referring to what you heard yesterday from these important agricultural countries, tell us what conclusions you draw from that? If we have to grow twice as much food, have only ten percent more land to cultivate and must use significantly less water, we are going to face several crises. How long is it going to take for us to do something about it?

Janken Myrdal: There are so many agricultural systems and every culture is kind of a miracle in its own, so there is no way we can apply one solution on all countries. Africa asks for good leadership; India requests for good policy; Russia wishes to do away with the disastrous “slave” mentality. Agricultural research will be highly important and enormous investments are needed to raise productivity.

However, I think we need to take also other issues into this discussion. We must build up global responsibility and trust, and acceptance of the specifics of the different countries’ cultural and agricultural systems. With our existing international agricultural organizations, we could create international discussion forums for agreeing on food redistribution, perhaps for restraining food consumption in some parts of the world. Possibly, we may solve our problems with agricultural technology only, but I believe we will need these discussions about responsibility and trust, etc. to succeed.

Speakers' profiles



Joachim von Braun is Director of the Center for Development Research (ZEF) and Professor in Economics and Technological Change at the University of Bonn. From 2002 to 2009, he was Director General of the International Food Policy Research Institute (IFPRI) in Washington. Professor von Braun is a leading researcher and policy advisor in the field of food security, agriculture, and development economics.



Janken Myrdal is Professor in Agricultural and Rural History at the Swedish University of Agricultural Sciences. Professor Myrdal's thesis covered agriculture and technological change in Sweden, 1000 to 1520. Lately, he has been studying global agricultural systems in a long term perspective.



Professor **Zhu Ling** is Deputy Director, in charge of International Cooperation, at the Institute of Economics, the Chinese Academy of Social Sciences in Beijing. Her main research interests are rural development, poverty issues, income distribution and social protection policies.



Dr. **Assefa Admassie**, is Executive Director of the Ethiopian Economic Policy Research Institute, which is part of the Ethiopian Economics Association.



Professor **Mahendra Dev** is Director of the Indira Gandhi Institute of Development Research in Mumbai. He has written extensively on agricultural development, poverty and public policy, food security and employment guarantee schemes. He has been consultant to many international organizations like the United Nations Development Programme (UNDP), World Bank, International Food Policy Research Institute (IFPRI), the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and has also worked as a member in committees set up by the government of India.



Elisio Contini is Head of the Department for Strategic Studies at the Brazilian Agricultural Research Corporation, Embrapa, and Professor at the Getulio Vargas Foundation. Since 1976, he has worked as a researcher in the socioeconomic area at Embrapa, where he has held different positions, including the leadership of the Central Unit of Budget and Planning.



Dr. **Eugenia Serova** is an economist and a member of the staff at the FAO Investment Center. She has served as Agricultural Advisor to both the Soviet Union and the Russian government. She is the founder and previous Leader of the Center for Agricultural Transition which is a “think tank” for the government in reforming Russian agriculture.



Professor **Robert Thompson** holds a Gardner Endowed Chair in Agricultural Policy at the University of Illinois in Urbana-Campaign. He has served as Director of Rural Development at the World Bank, and as President and CEO of Winrock International Institute for Agricultural Development.



Professor **Ewa Rabinowicz** is Head of Unit on Agricultural Policy Analysis at the Department of Economics, Swedish University of Agricultural Sciences. She has served as President of the European Association of Agricultural Economists from 1996 to 1999. She was member of the Economic Council of Sweden from 1994 to 2000 and is at present member of the Advisory Board of the Swedish Institute for European Policy Studies.

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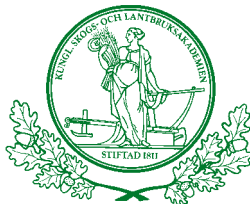
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Food security entails the challenges of overcoming today's hunger, feeding a population that by 2050 is predicted to be more than 9 billion, and achieving all this in sustainable ways. World agriculture production and food systems are in a process of rapid transformation while food security remains highly unsatisfactory and appears increasingly at risk.

Populations connected with small farms include the majority of the world's poor. What will be the future of small farms? And, what will be the role for large scale farming? What is and should be the appropriate responses to resource scarcity, for example land and water shortages, and to climate change? Technology and agricultural research investment (public and private) could facilitate innovation. How can this be accelerated and how can the access to improved technologies be enhanced?

This report of the Bertebos Conference 2010 outlines challenges and long-term outlooks for food security and the futures of farms. Speakers from China, Ethiopia, India, Brazil and Russia give their views on how small and large scale agriculture are developing in their countries and continents. Trends and possible scenarios for the future are presented. Certain threats will most probably be overcome. Others do require our urgent action.



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