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Kent Olson (Professor, Simon Brand Memorial Lecture)

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# TRENDS, ISSUES, THREATS, AND OPPORTUNITIES AFFECTING FARMERS

Kent Olson\*

Simon Brand Memorial Lecture  
Agricultural Economics Association of South Africa  
Bloemfontein, South Africa  
1 October 2012

## ABSTRACT

Change is always upon us. How we respond is the question. In this talk, I look at the world from a producer's or farmer's perspective in the bigger industry called agriculture. I focus mainly on conditions and trends in the macro-environment, causes of change, and who is making strategic moves. I discuss the trends and issues raised by these questions in terms of what we as economists can do to address them with our research and teaching and as decision makers in farms, businesses, government, non-government organizations, and academia. I start with four large trends and issues: population growth, climate change, the global economy, and energy. I also briefly discuss resource availability, environmental concerns, technology, supply chains, structural change, policy, and smallholder farming. For each issue, I suggest questions and needed analyses that we as economists could address and help farmers and many others deal with these changes and improve the likelihood of a better future. We economists have the tools and ability to help them answer these questions and help them build robust strategies that will allow them to change, survive, and prosper in a world that is always changing.

JEL: Q12, Q13, Q16, Q17, Q54

Keywords: farming, population, climate, energy, environment

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“It is not necessary to change.  
Survival is not mandatory.”  
– W. Edwards Deming

## 1 CHANGE IS ALWAYS UPON US. HOW WE RESPOND IS THE QUESTION

Today, I take a step back from our daily grind of work and look around the world and think about possible futures. I approach this task using some of the questions from external analysis within strategic management (Table 1). Some of these questions are oriented towards a specific industry and set of companies, but I want to look at the world from a producer’s or farmer’s perspective in the bigger industry called agriculture. I will focus mainly on the first, fourth, and sixth questions: conditions and trends in the macro-environment, causes of change, and who is making strategic moves. I will discuss the trends and issues raised by these questions in terms of what we as economists can do to address them with our research and teaching and as decision makers in farms, businesses, government, non-government organizations, and academia.

Now and into the future, I see four large trends and issues affecting agriculture (and all of us in all aspects of our lives):

1. Population growth
2. Climate change
3. The global economy
4. Energy

After looking at these, I will discuss some smaller (but still big) trends and issues including resource availability, environmental concerns, technology, supply chains, transportation, structural change, policy and smallholder farming.

As a visitor to your country, I realize there are four large issues for South Africa’s agricultural industry. These are land tenure, farm security, the continuing transition after the 1996 vote, and HIV/AIDS. These have and will have large impacts on future farm productivity and food production in South Africa. However, you all know these issues and concerns much better than me, so I do not plan to discuss them today but want to acknowledge the impact they will have.

## 2 POPULATION GROWTH

By far the biggest trend affecting farming around the world is population growth. From 6.9 billion people in 2010 to 9.3 billion in 2050 – 2.4 billion more, 35%

more, in 40 years (Figure 1).<sup>1</sup> The year 2050 is not some date far away. It is within the lifetime of many of us in this room.

And it is not just the dramatic increase in the number of people. Rising incomes and many other factors will change what and how much people eat (Kearney, 2010). In their study of the Chinese diet over three decades, Li and Shangguan (2012) found national per capita annual consumption of meat had more than doubled from 12kg in 1980 to 28kg in 2010. Rising demand for meat will increase the demand for feed and, thus, demand for land, water, fertilizer and other inputs.

Can we meet this demand for more food? How will the world feed 9 billion? How will we improve their food security and better meet their nutritional needs than we do now? We could easily become depressed.

The world has been in this state of despair before. Malthus (1798) is the most famous, early predictor of doom. But other doomsayers came along too. In their recent IAAE paper, Pardey, Alston and Kang (2012) describe the recurring theme of despair and dire predictions that we will not be able to feed the people in the world. However, the world adjusted, agricultural productivity increased greatly in the last half of the 20<sup>th</sup> century, and the dismal end did not occur. Now, with the recent spikes in food prices and concerns over productivity and an increasing population, we hear this theme of a future lack of food and a dismal end being raised again.

So, we're back to the earlier question: can we meet this increased food demand? Vermeulen, Campbell, and Ingram (2012) point out that the trend of food supply increasing more rapidly than population growth in the second half of the last century has been reversed in the last decade. Pardey, Alston and Kang (2012) show that global crop yield growth has slowed especially in high-income countries, but that in middle-income countries, spending on agricultural research and development (R&D) is increasing and productivity growth has not slowed. In their review of the literature, Godfray *et al.* (2010) find two conclusions: (1) that major advances in sustainable food production and availability can be achieved with the application of current technologies (if we have political will), and (2) that investment in R&D needs to start soon in order to cope with future challenges. Foley *et al.* (2011:337) conclude that the world could meet future food needs sustainably by "closing 'yield gaps' on underperforming lands, increasing cropping efficiency, shifting diets and reducing waste" even without new agricultural lands. Beddington *et al.* (2012) also conclude that widespread use of sustainable agricultural practices can reduce risk to food production, farmer incomes and the environment. Freibauer *et*

1 Medium projection of Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2010 Revision, <http://esa.un.org/unpd/wpp/index.htm>.

*al.* (2011:9) conclude that “a radical change in food consumption and production in Europe is unavoidable to meet the challenges of scarcities and to make the European agro-food system more resilient in times of increasing instability and surprise”.

As economists, we also know that as demand for food rises so will the price of food if production does not keep pace with demand. Higher prices will dampen demand. For example, rising income usually means higher meat consumption. Higher meat consumption will raise demand for feed grains, which means higher grain prices. Higher prices will cause potential demand to not be realized. As this economic story unfolds, we will see some in the world will increase their low meat consumption due to rising incomes while others will decrease their high meat consumption due to rising meat prices. The only questions we have in this partial story are how much will each group adjust their meat consumption and how will they adjust their consumption of other goods.

For farmers, the rising population raises the issues of product choice, production efficiency and location of production. As Godfray *et al.* (2010), Foley *et al.* (2011), Beddington *et al.* (2012) and Freibauer *et al.* (2011) point out, production needs to increase in efficiency and sustainability. Farmers need to evaluate how to produce to improve the efficiency of their resources. Rising prices will naturally adjust production methods and input choices in order to improve productivity due to the higher marginal value of traditional and new inputs. The need to preserve natural resources may create new policies that affect input choice (e.g. fertilizers and pesticides) and production location (e.g. proximity to water sources). Geographical differences in population changes may create changes in what is optimal to grow in an area compared with historical production patterns. As economists, we can monitor these changes at the macro level, help farmers understand how changes may affect their operations now and in the future, and help design policies and institutions to guide future production choices. By doing so, we will help farmers, businesses, governments and the public adjust in an orderly fashion.

## CLIMATE CHANGE

If we accept science as a legitimate provider of knowledge, we should find it hard to reject the fact of climate change. Regardless of the argument of cause, we will need to adjust to a different future – a future with higher temperatures, more variable weather, different rainfall patterns, higher sea levels, and increased food insecurity. A sample of the literature covering the trends, drivers, patterns and general impacts of climate change includes Solomon *et al.* (2007), IPCC (2007) and IPCC (2012).

Agriculture (and the entire food system) contributes to climate change, is affected by climate change, and can help mitigate climate change (Deressa, Hassan and Poonyth, 2005; Steinfeld *et al.*, 2006; Schmidhuber and Tubiello, 2007; Lobell *et al.*, 2008; FAO, 2008; Nelson *et al.*, 2009; Vermeulen *et al.*, 2010; DiFalco, Verones and Yesuf, 2011; Ringler *et al.*, 2011; Hammond and Dubé, 2012; Malcolm *et al.*, 2012; Vermeulen, *et al.*, 2012; Vermeulen, Campbell and Ingram, 2012; Grace *et al.*, 2012; Waha *et al.*, 2013). Potential policies that have been implemented and proposed to mitigate climate change and that affect farming contain subsidies, fees and prescription of practices. Climate change brings both potential threats and opportunities to farmers in all parts of the world – even without policy changes.

In the northern hemisphere, our temperatures are rising earlier in the spring and staying higher into the fall. On average, we have longer growing seasons with higher growing-degree-days (GDDs) each season. With more GDDs, farmers have the opportunity to change their cropping mix to include crops they could not grow previously. Plant breeders and plant geneticists have already adjusted plants such as maize and soybean to grow at cooler latitudes. Rising temperatures allow the new varieties to move farther into previous cooler climes. This phenomenon can be seen in North America where both soybean and maize have moved north as genetics and climate have allowed farmers to take advantage of better profit potential in these crops compared with others.

Greater weather variability also means greater variability in local precipitation patterns affecting production in rainfed agriculture and water supplies for irrigated agriculture. Thus, farmers may be faced with a need to change both the crops they grow and the production methods to grow their traditional crops. This too is both a threat and an opportunity. A decrease in total rainfall coupled with an increase in the variability of rainfall within the year and between years may reduce the economic viability of a traditional crop or even take away the physical ability to grow that crop. Changes in weather patterns may also affect expected crop response to inputs (e.g. fertilizer), the expected marginal value of different input levels and, thus, optimal application levels. Conversely, the change in weather may increase the physical and economic viability of another crop in a specific locality. Farmers will be faced with how to detect the need to change optimal input levels as well as whether the optimal mix of crops and livestock has changed on their farm and the timing of when to make these changes. The choices surrounding insurance and other risk management strategies will continue to be critical in the future. Taken together these changes may affect the overall viability of the farm. Anticipating these changes and making appropriate, timely changes in management and ownership will be crucial to farmers' successful accomplishment of their personal and business goals.

Greater weather variability will also likely mean greater variability in local food production but not necessarily at a larger geographical area (Malcolm *et al.*, 2012). So another set of questions include the impact of trade patterns and need for inventories. How will trade patterns change with geographical shifts in production location? Will countries and regions switch from producers and exporters in one year to being net importers in another? What impact does this have on the need for transportation infrastructure?

Increased volatility in production combined with a higher population implies a need for higher inventory levels in order to stabilize annual consumption. What levels of inventories are needed? Who will manage, control, and pay for these inventories? Where will they be located? Will inventories be managed globally, regionally, or nationally?

In recent years, drought resistant crop varieties have been developed with a main purpose of increasing food production by allowing production in areas where current genetics do not allow production because of low rainfall and no real irrigation potential. In addition, these drought-resistant varieties will improve the chance for farms to continue growing crops such as maize in traditional areas where rainfall is becoming more variable. However, this new technology has impacts in other ways also. The new varieties will allow these crops to be grown in new production areas where less thirsty crops are currently grown. The coming competition between drought-resistant maize and wheat in traditional wheat areas in the U.S. is one example of these changes. In irrigation areas using aquifers with dropping water tables, will drought-resistant varieties allow farmers and the local supply chain infrastructure to remain viable? How much will these new varieties allow areas with limited rainfall and (or) irrigation water supplies to increase planted area? We economists can help farmers evaluate the viability of the traditional crops compared with the drought resistant varieties in terms of expected profitability and the variability in that profit. What is the resulting impact on crop insurance – premiums, payments, and the definition of good practices? Businesses in the value chain will be very keen to understand how likely farmers will be switching to new crops and thus needing new input supply chains as well as the need for infrastructure for buying, processing, and shipping new products (and the decreasing need for the “old” infrastructure).

In regions where climate change decreases the supply of water or a rising population increases the need for urban water, what will the mechanism be for those with existing water use rights to pass those rights to other users? Will water rights be taken from agriculture for use in urban centers? What will be appropriate compensation for those actions?

Another aspect of warming temperatures is a changing pest pressure or problem. As winters become less severe in temperature and duration, more

insects can overwinter. New pests will move into previously inhospitable regions and the overwintering population of current pests will increase. As previously cooler latitudes become warmer, weeds will migrate there along with desirable, commercial crops. Thus, the pest pressure on yields will increase and so does the need for pest management and control. Economic research is needed on the value of new pest strategies and the continued viability of crop and livestock production. There will be a continuing need to re-estimate economic thresholds for pest control. Farmers will also need to consider the effect of an overwintering pest population and the potential damage in the next production period, and, hence, the need to re-evaluate late season treatments designed to control pest pressure in the next growing season. What will the impact be on leasing or renting of land if farmers become faced with the need for late season pest treatments for control in the next season?

Will the rate of climate change continue? We economists will need to work with as well as monitor what the climate scientists say concerning the rate of change. This will determine the speed with which farming and the supply chain will need to change. Do we have any contingency plans for how to adjust to a relatively sudden change, such as the “tipping point”? Has anyone thought of what could be done in the short term and in the long run if a “tipping point” were to occur?

A basic question we economists can help answer is what changes in the location of production will likely take place due to climate change, population growth and increasing costs of transportation. These changes will affect farming as well as the demand for and location of supporting infrastructure. This is essentially the estimation of costs of production per unit and then the comparison to the costs in other production areas both in the same country and in others countries. What areas will have higher populations and thus higher food demands and which production areas will be the least cost provider after accounting for transportation costs? Which areas will need new infrastructure for new products and which areas will have infrastructure that is longer needed or used? Farmers and agribusinesses who want to make long-term, expensive investments will want to know the likelihood of a long economic life.

## THE GLOBAL ECONOMY

Another major concern for farmers is not just the condition of their own country’s economy but also the condition of the global economy as well. Will we experience another global recession soon? Are we in the middle of a “lost decade” in the world economy? Will emerging markets continue to emerge? Will per capita income continue to rise in China, India, and other countries as well as their population? How will globalization unfold in the future?

The financial crisis and recession of 2008–2009 is certainly dragging on. Regardless of what the “official” definition of when the recession ended, many people still consider themselves in a recession, and they won’t think the recession is over until their jobs come back. The official definition involves the decline in economic activity and the recession is over when the decline ceases. The street definition of a recession involves the whole trough. Hence, consumer confidence has not yet recovered.

The continued global concern of slow growth and the fear of a second dip should not be lost on the agricultural sector. We think, rightfully so, that we produce food, fibre and energy that have inelastic demand and a smaller income elasticity compared with other products. This is especially true for food. However, producers of energy know this isn’t true for them completely. Some ethanol plants have sat idle waiting for the price of oil to rise and/or the price of maize to drop so that the demand and thus the profitability of ethanol also rises. Cotton fibre for clothes and other uses also suffers a decline in demand. Food demand also declines in a recession with the type of food and location of consumption changing more than total food demand. In the developed world, the first impacts of a recession are less food eaten away from home and a shift to less expensive foods. This could be described as a shift from eating steak in a restaurant to steak at home, then hamburger at home, and finally beans at home as a source of protein. In less developed economies, decreased family income likely means a partial or complete change from meat (if they are consuming meat) to beans as a protein source and then reliance on the usually inadequate protein available in carbohydrates and ultimately an inadequate level of nutrients. This shift is especially devastating for children. If income drops too much, total caloric intake may be insufficient and household funds for additional food, medicine, education and other goods purchased in the market may be severely curtailed. The household may experience a longer “hunger” season, poorer health, less strength to work, and descent into the poverty-hunger trap. For economists, this indicates a need to help allocate a probably declining level of development aid and a need to help build the resilience of smallholder farms to endure decreased global economic activity.

For farmers, the health of the global economy impacts on the demand and thus price for their products. It is a question of the value of their resources. This effect is exacerbated if they are at the far end of the supply chain where they are the first to experience a downturn in demand as suppliers closer to the demand can be more competitive than those facing higher transportation costs. Farmers need to understand whether the global economy is in a slow recovery period or is likely to slip back into a recession. While this question has only a highly uncertain answer and depends on the region of the world, we economists can help by interpreting the signals and expanding on whether a certain farm or region should be considering

the options of how to survive until the economy improves, or to make rather drastic decisions on whether to remain in business in their current form. This is basically a question of what the short- and long-term demand will be for the farm's resources and the products that can be produced by that land, labour and capital. Should the resources remain in place in preparation for better days economically? Or should the resources be allocated to other uses, other regions? Are there other doors open? Even with the previous discussion of a rising population and food demand in the long term, a slow recovery may signal the need for labour and capital to be used in other parts of the economy to receive a fair return in the near term.

## ENERGY

Energy! We all use it. Most of us will use more. The U.S. Energy Information Administration (EIA) predicts that total world energy use will increase by 53% between 2008 and 2035 (EIA, 2011). With increasing demand for energy and fixed or somewhat fixed supplies of oil and coal, what is the expected long-term direction of the prices of carbon-based fuels? Yes, you are all correct: Up! Short-term events can affect the price drastically, but the long-term expectation is higher prices. Political instability in major oil countries adds to the level and uncertainty of prices. Alternative sources such as wind, solar, water and bio-based fuels are not price competitive at this time otherwise they would be used more widely than they are currently and adopted without subsidies and incentives.

As economists, the wide topic of energy gives us an endless supply of research questions. Narrowing that list to the viewpoint of farmers, here are a few questions for us to consider.

- How do optimal production practices change as energy prices increase?
- What is the optimal fuel efficiency in machinery and buildings given predicted price increases?
- How will changes in prices and optimal fuel efficiencies affect the mix of land, labour and capital on farms? How does this affect the optimal farm size?
- What is the value of higher energy efficiencies in terms of firm size and survival?
- What is the value of on-farm production of energy – biogas, burning, solar, wind, bio-fuels?
- What will the impact of rising energy prices have on the prices of other inputs (e.g. nitrogen fertilizer) and on the optimal level of using those other inputs?
- Will the rising cost of transportation change trade levels, routes and trading partners, and thus the products that local farmers should be producing?

## RESOURCE AVAILABILITY

As demand for food, fibre and energy increases, will there be enough resources (land, water, sunlight, labour and capital) available to meet that demand? And at what price will those resources be available? These questions involve not only the totals for the world, but also the amounts available and price levels for farms at the regional and local levels.

Land and water are obvious concerns, but this concern over availability reaches to other inputs and resources. For instance, will the demand for fertilizer (e.g. potash) increase at a faster rate than the supply of that fertilizer and will shipping costs change the profitability of current transportation patterns thus creating a “shortage” of some fertilizers in areas that now have sufficient supplies? How will this affect the production practices and crop choices in these areas? If air pollution and increased cloud cover decreases sunlight available to plants, can production levels be maintained?

Farmers’ access to capital is another concern as they face new rules and regulations for loans and information. Which farmers will be better able to meet these conditions, receive the capital, and, thus, become more competitive? In emerging markets, will credit be available to farmers to transform production practices and supply? Will microfinance truly increase the amount of capital available to small farms in developing countries? How will these changes affect the whole community?

This concern of resource availability extends to labour – both in terms of quantity and quality. Some larger farms in both developed and developing countries are concerned about have sufficient supply of appropriately skilled labour. The concern for and actual lack of this supply have driven and continue to drive these farms to substitute capital for labour at a level perhaps greater than the marginal rate of substitution would indicate. Immigration, illegal immigration and lack of immigration affect the supply and use of labour as well; economists can help clarify the impacts of restricted and unrestricted international labour flows. The lure of non-farm jobs in urban areas pulls many potential farm workers away from farming even though they have the skills that farmers are looking for. This latter trend has been occurring since the industrial revolution and is likely to continue. How will this shape the size, type and location of farms in the future?

The future supply of technology is affected by and reflected in the concern over future productivity and the level of agricultural research around the world. Improved seeds and animals are seen as needed to meet the food needs of an increasing population. Which countries will make the research investments needed to increase productivity with better genetics and better management skills? Will the new technologies be transferable (physically, economically and politically) to other areas? If some areas receive and adopt the new technologies and some

do not, how will this affect farmers' choices, production location, trade patterns and the well-being of the local populations in both areas? Will concerns over genetically modified organisms delay the increase in food production needed to meet increased population? Who will control the seed systems developing and distributing improved seeds in the future?

## ENVIRONMENTAL CONCERNS

Sustainability is a word we have heard for many years and will continue to hear. Environmental concerns are still present even though the global recession and other concerns pushed long-term concerns out of the headlines even though large disasters still make the headlines. Concerns over soil, air and water quality are and will become more important as the population increases and we push production onto more vulnerable land. As noted earlier, many researchers think it is possible to meet future demands for food, fibre and fuel without damaging the environment but production practices would have to change dramatically. Hazell and Wood (2008) develop a typology to explore the linkages between human needs, agriculture and the environment, and show how it can be used to assess options for addressing future food security, land use and ecosystem service challenges.

Farmers face many issues related to the environment as shown in the following questions that we economists can help them answer.

- How can production practices be changed to have a lighter footprint on the environment without imperiling total food production for an increasing population?
- As the population increases in megacities, how can production be situated to reduce its environmental footprint? How viable are the ideas for urban farming especially in mega cities – economically and environmentally?
- What will be the impact of removing production methods and tools through policy (e.g. certain pesticides for their toxicity or certain tillage methods near surface water or prophylactic drug use in livestock) have on total production and location of production? What are the impacts of putting these concerns into non-tariff trade barriers?
- Is local food production a viable alternative to distant production? Which source has a smaller carbon footprint per unit at the point of consumption? Which delivers a lower cost per unit? What are consumers willing to pay for?

Environmental concerns can be introduced to the ongoing management of a farm through the use of the balanced scorecard (as well as economic comparison of production costs). Kaplan and Norton's original scorecard includes four perspectives for the manager to monitor and balance: customer; internal business; innovation and learning; and financial (1992; 1996a; 1996b). Following Dunn *et*

*al.* (2006), I expand the original scorecard by adding two additional perspectives for farmers: natural resources and family, lifestyle, and community (Olson 2011). These perspectives and the measures in each perspective need to be monitored and optimized together in order for the business to have a balanced approach in its operation and its results. Environmental concerns can be included in the natural resource perspective and, just as importantly, in terms of customers' concerns.

## TECHNOLOGY

My view of technology is broad – from computing to machinery to production methods to biotechnology to management. For farmers, technological change creates both threats and opportunities. We economists can help answer not just the question of whether to adopt a certain technology, but we can also help answer how the adoption by others will affect their choice and even, perhaps, their survival. Absolute and comparative advantages may change with technology especially if policies constrain choices in one region or country versus other areas.

Changes in technology will affect not only how production takes place, but also how farmers communicate and manage their businesses. Telecommunications, especially the mobile phone, is changing the way banking transactions are made and even how products such as crop insurance is determined, administered and paid. Market price information is now available through texts. Telecommunications is even changing the way chicken farmers operate in Kenya (*Economist*, 2012). Recently, in a remote area of Rajasthan in India, I visited with a farmer who described the benefit of having a mobile phone. To discuss an issue with a neighbour on the other side of his disperse village, he could just call rather taking the time to walk there and back. If he needed a job in the city for some extra cash, he could just call his contacts to see if there was work available rather than paying for bus fare and taking a day just to see if there was work available. This seems simple to most of us, but consider the quantum leap in benefits to this family of having mobile communications in their village.

Where do we economists fit into this? From an applied research perspective, we can help farmers assess their needs and the potential for technological advances to help them solve their problems and improve their efficiency. We can help companies developing technology determine the market demand for their applications. We can show farmers how adopting certain technologies can improve their businesses and their income potential. This work may not be done by economists in academia, but we can certainly prepare our graduates to do this work in their private businesses and government agencies.

## SUPPLY CHAINS

A main issue in both local and global supply chain management is how to communicate and build relationships between players in the supply chain or, as some call it, the value chain. Two recent studies look at the agri-food supply chain in southern Africa (Ortmann and King, 2010) and midscale food value chains in the U.S. (Stevenson *et al.*, 2011). The goal in supply chain management is to look for ways to decrease costs and capture value for the whole chain instead of each link operation in isolation of other links. The goal is to look for duplication in efforts, costs that can be erased, and greater communication to avoid costs and increase efficiency and value. Higher levels of communication can decrease transaction costs and thus raise returns and reduce risk for businesses in the chain.

Conventional supply chains are undergoing change, not just streamlining for efficiency but fundamental change due to the changes in communication, transportation technology, and consumer preferences. For example, the increasing demand for locally produced food has grown at the historical source at farmers' markets and now also includes a supply path within the major grocery stores and their suppliers.

In many developing countries and economies, supply chains to local markets and distant, or relatively distant, markets are being created. The improvement in people's lives, the decrease in poverty, can be traced to the improvement in these supply chains. We economists can increase the information needed by evaluating potential production areas, distant markets, and the transportation and communication links available as well as those links needed.

We economists can also help by evaluating what products can be demanded and grown locally and, if needed, making the connections between producers and retailers or providing training to farmers on how to sell directly to consumers. Economists can also help producers by monitoring trends at the other end of a long transportation route and relaying information on whether local producers are starting to increase their market share, thus creating a need for the original producers to look for new markets or new products.

Improved or new supply chains can and will be created either through individual efforts or through collective efforts. One example of collective action is the promotion and development of clusters is here in South Africa. The AgriZone part of Dube Tradeport near Durbin is developing a set of facilities and services to support and grow the perishables sector in the area.<sup>2</sup> The plan is to develop the production and the supporting businesses and the transportation capability to market to other countries. This deliberate clustering and incubating of a major part of a supply chain will hopefully improve the communication and information

2 <http://www.dubetradeport.co.za/> (accessed 27 September 2012).

sharing so the resulting chain will be more efficient and competitive in world markets. McCormick (1999) looks at some early efforts in clustering enterprises in Kenya.

## STRUCTURAL CHANGE

All of these forces and changes are affecting the structure of the agricultural industry, that is, the number, size and scope of firms at each level of the chain and the connections between these firms. In their analysis of raising broilers, feeding cattle, and growing vegetables for processing, Reimund, Martin and Moore (1981) found that forces outside farming trigger structural change, at first to exploit new conditions, and later to manage new risks. They found that new technologies, market conditions and policies set off a four-stage process: technological adaptation, shift to new producing areas, growth and development, and adjustment to risk. More recently, Clayton Christensen at Harvard University talks of disruptive technologies and innovations that cause fundamental changes in industries beyond just new production methods (Bower and Christensen 1995; Wessel and Christensen 2012).

We economists can develop information on which changes may be “disruptive technologies” and how these changes will affect the sizes, types, and diversity of farms, agribusinesses and consumers. We can work through what are the likely optimal sizes or range in size and the minimum efficient farm size. We can also study the development and impact of the so-called “super farms” that are being developed internally to a country as well as being “brought in” from external sources. At the retail side of the supply chain, the local impact of changes such as Walmart opening stores in India on the smaller store and the supply chain needed to supply a larger store compared with the chain needed for the smaller stores can affect the optimal size of the producing farms, not just the store size.

The current concern over the “land grab” in developing countries can certainly be seen as a disruptive technology and a change in industry structure. In some instances, this is a phenomena of globalization in terms of farmers moving or diversifying into another country such as U.S. farmers starting to farm in South America (Taylor, 2012, for example) or South African farmers looking in Georgia (Van de Walt, 2011, for example). In other cases, the “land grab” involves foreign ownership or leasing of vast tracts of land using modern methods and machinery and very little local labour. These farms produce primarily, but always exclusively, for foreign markets and in some cases are very closely aligned with foreign governments. Zoomers (2010) and Robertson and Pinstrup-Andersen (2010) provide recent reviews and analysis of the conditions and suggestions for how to respond to these land acquisitions. Provost (2012) is a more recent discussion of

these trends and includes a link to a database that catalogues acquisitions at <http://landportal.info/landmatrix>.

## CHANGING POLICY

The impact of policy changes has always been a favourite topic of economists and will be in the future. Major changes in local, national and global policy are happening that will affect agriculture are happening perhaps majorly due to the current recession and budgetary pressures faced by many nations. We have and will have fertile ground as economists to help design and analyze the impacts of new policies for consumers, processors and producers of food as well as all the trade and transportation connections.

A common concern in many countries is the national budget for agricultural research and development and for extension and advisory services for farmers. What is the needed and optimal level and type of public research and appropriate mix of public, private or public-private collaboration? Developing countries with many smallholder farms are faced with the question whether to encourage a “leap frogging” to larger scale, industrialized farms, to subsidize and maintain the pattern of many smallholder, crop-livestock farms, or a combination of these two efforts.

## SMALLHOLDER FARMING

Every farmer of every size is striving to provide a better living for their family. This is usually done through striving to obtain better product prices, increasing the size of the farm, increasing resource use intensity (e.g. more livestock for the land area or increased use of purchased inputs), and improving efficiency in the use of current resources. A common method for improving market prices is increased market participation by improving access to markets. Among many reasons, increased market participation is hampered by poor market information, lack of storage, poor roads, and lack of equipment to haul the product to market in a timely manner.

The development dilemma is how to help some farmers grow and others to exit farming and whether to choose which farmers do which or whether to provide the information and let the individual farmers choose. Part of improving the livelihood or well-being of farm families is helping them start the transition to either financially viable farms or non-farm jobs. As economists, we can help policy makers in and out of government see the alternatives and the benefits and costs of each alternative. Barrett (2008) suggests a three-pronged strategy for helping raise incomes in developing countries aimed at farmers who already participate in the market, improving market participation, and improving the availability of jobs for those who leave farming. His three strategies are:

1. Improving macro and sectoral price and trade policy for wealthier farmers participating in the market;
2. Where market integration is weak (by farmers and by region):
  - Designing micro and meso policy to improve access to financial services, technology, and asset building for farmers; and
  - Local infrastructure improvements; and
3. Developing policies to absorb those who leave farming.

I thought of this three-pronged strategy and the concerns over the “land grab” mentioned earlier, as I stood on a hill on the edge of Nekemte, Ethiopia. Not so far away, we could see the flat valley where large farms had displaced small farms. Apparently, the large farms were producing well, but local labour was not used and the production and most of the income was shipped out of the area. At the aggregate level, agricultural production may look like it had increased but the local community had not benefited proportionately. Around us on the hill (and other hills nearby) were small, essentially subsistence farmers and families striving to eke out a life. For these farmers tucked into plots on the hills, market integration was weak to non-existent and there were not a sufficient number of non-farm jobs to support the families well. Helping the larger farms in the valley may be beneficial by some measures. Acting on the latter two parts of Barrett’s three-pronged strategy would help a larger number of people on the small farms and their local community and economy.

## SOME CONCLUDING COMMENTS

In this talk, I discussed four large trends and issues affecting agriculture: population growth, climate change, the global economy and energy. I also discussed some smaller (but still big) trends and issues including resource availability, environmental concerns, technology, supply chains, transportation, structural change, policy and smallholder farming. For each issue, I have suggested some questions and needed analyses that we as economists could address and help farmers and many others deal with these changes and improve the likelihood of a better future.

Farmers, large and small, rich and poor, are asking, “How can I survive today? Tomorrow? How can I prosper? How can I improve my family’s livelihood? How can I create a better life in the midst of all this uncertainty and change?”

We economists have the tools and ability to help them answer these questions. However, we do live with uncertainty and change. So, in our analyses we should aim at providing farmers the information they need to see alternative scenarios of the future and build robust strategies that will allow them to change, survive and prosper in a world that is always changing.

Thank you for your time and attention.

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Table 1. Eight questions for external analysis.

1. What are the conditions and trends in the macro environment?
2. What are the industry's dominant economic traits?
3. What is competition like and how strong is each of the competitive forces?
4. What is causing the industry's structure and business environment to change?
5. Which farms are in the strongest/weakest competitive positions?
6. What strategic moves are others likely to make next?
7. What are the key factors for competitive success?
8. Is the industry attractive and what are the prospects for above-average profitability?

Source: Olson (2011)

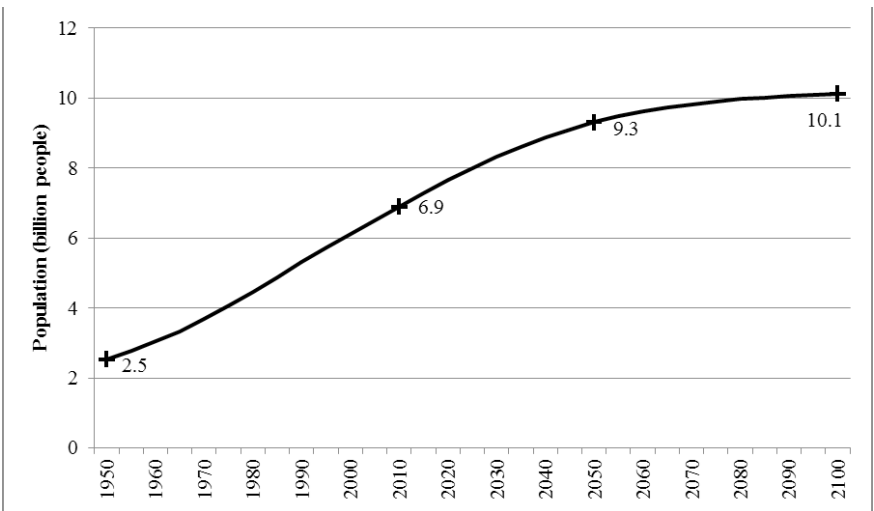


Figure 1. World Population, 1950-2100

Source: Medium projection of Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2010 Revision, <http://esa.un.org/unpd/wpp/index.htm> (accessed 19 September 2012).