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"Transcultural Impacts and Perspectives on the Future"

Perspectives from Canada, Italy, South Africa, Southeast Asia, Southwest Asia (Middle East), the United Kingdom, and the United States of America.

Global Agriculture 2020

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Although agriculture is one of the oldest of humanity's economic and cultural pursuits, the 21st Century is seeing rapid and dramatic changes in how it is being undertaken both in individual cultures and across the globe. In this article, I will look at global agriculture in a broad context, across its social, economic and environmental aspects – including access to technology and evolving regulatory and trade issues – and how these trends interact. As in all foresight, there is always a choice between attempting to influence the future and working to adjust to coming changes. But whatever route is chosen, it is essential to understand the dynamics of the global and national systems that affect agriculture and food production generally, and how they interact.

It is impossible to talk about agriculture in isolation, as the future has become increasingly interconnected across the globe. Accordingly, the time when any issue can be identified and acted upon in isolation is disappearing. For example, our growing understanding of world climate change has increased our appreciation that systems of every sort are interconnected and interactive. And like climate change, agricultural globalization may be both bringing cultures together and driving them apart.

While the subject of this article is cultural trends, I will discuss a series of other trends – Technology; Culture and Globalization; Economics and Trade; Engineering; Environment – as the cross impact among them is high. Accordingly, cultural factors are just as critical as technology or economics and vice versa. The value of any new technology (for example genetically modified foods) must be played off against questions of implementation feasibility – including market demand, cost, production and delivery infrastructure, regulatory restrictions, and social/cultural acceptance.

Technology

In many arenas, technology is a driver of change, but recently agriculture has not been as responsive to the miracles of science. While food production rates expanded faster than population from the 1950s through the mid-1980s, that has reversed over the past two decades. Desertification, soil erosion, and conversion of cropland to other uses all added to this, and falling water tables and rising global temperatures have intensified the rate of change. While new strains of grains and improved fertilizers offset these declines somewhat, no truly revolutionary technology improvements have been introduced in the 21st century, and the global growth of land productivity has slowed by half since 1990. Specially, while grain yields rose about 2.7 % annually in the 60s and 70s, that rate of expansion dropped to 1.6% annually in the 1980s. Global food demand is expected to triple by the 2080s, and this shortfall could be intensified by the increasing shift of land to production of biofuels. Accordingly, food shortages, rising prices and the politics of scarcity will likely continue over the coming decades.

Another continuing challenge is energy availability. While agriculture becomes increasingly dependent on reliable power, especially as the scale of production increases, power has become more problematic, especially power from petroleum. There has been talk about the potential for renewable energy, but it must be reiterated that renewables continue to represent very little of the market. For example, although Mexico has the third greatest potential globally for both geothermal and solar power (at a level 50 times present levels), industry projections for renewable power 2030 are at only 3% of total national energy sources.

It is possible that oil prices will actually drop slightly after 2009, as more supplies of crude and other fuels come on the market. Longer term improvements in search technologies, plus new energy sources, may keep abreast of increased worldwide demand – to keep longer term price increases relatively modest.

The promise of new agricultural technology is always there. This promise may include cheap solar energy on site; rural wireless connectivity; ubiquitous information access; GM (genetically modified) crops with improved nutrition and production potential; rapid on-site bioassay; effective local water filtration and purification (including pollution eating bacteria), and cheap autonomous housing. GM foods research, for example, has produced insecticidal strains of corn, but the resulting death of pollinating insects is a continuing issue.

Customers in the US and elsewhere around the world now want to eat more fresh vegetables and fruits for health and weight reasons, but then there are related sanitary challenges. As the technology allows better tracking of disease and bio safety so will the issues of food safety, animal health, process assurance and quality get greater attention. Especially, concerns over avian influenza and cattle-based BSE (mad cow disease), along with other animal health issues, will continue to expand. Technology responses will include hand-held bio testing in the field, and at shipping and processing plants, education of production staff as well as proactive scanning technology to prevent contamination while still remediable.

Culture and Globalization

One of the most critical trends of the 21st century is immigration.
Immigrants now account for more than 15 percent of the population in more than 50 countries. And the 20th Century model of assimilation seems to be shifting to diversity together. Developing country population growth rates remain nearly double those of developed countries (developing countries will be 84% of total world population by 2017), which will further enhance food demand, along with projected

economic growth. Expanded food production in Brazil, Argentina, Canada, Ukraine and Russia will further complicate the global marketplace.

At present, the global population is evenly divided between urban and rural, but by 2030 over two-thirds of that global population will live in cities and 80 percent of urban residents will be in developing countries. This will be more than just the megacities as now mid-sized and even smaller cities are being caught up in these accelerated growth patterns. This means less land for agriculture, but also shorter distance to market and more access to an urban labor market.

The longer term decline of the power of nation states over the past decade or two is now being offset by a rise of nationalism that is fraying numerous global business ties…..These counter forces are further complicated by growing global marketing driven by improved transportation and preservation technologies such as the increased success of New Zealand cheese worldwide.

While some countries have retained many their smaller traditional production facilities, production scales for dairy, swine and poultry and grains are growing very rapidly in the rest of the world, especially the United States and Canada. Growth of large scale processing, especially in animal agriculture to serve global markets, will continue to be a political issue. In truck crops and grain it is also a farm strategy issue, as large scale mono-cropping can lead to disastrous losses to disease when the vulnerability of single crop farming is not balanced by the buffer of a variety or crops.

Economics and Trade

The economics of food production is becoming more complex over time. While the number of undernourished people declined by 37 million in the 1970s, and by 100 million in the 1980s, it declined only by 20 million in the 1990s and grew by 23 million since 2000, largely because of drought, environmental disaster, overfishing, etc.

Demand for animal protein varies directly with the growth of domestic income and population. With a move away from staple foods toward increased diet diversification, customers make more specific demands about nutrition, health, and production practices. Lifestyle changes from new values (health and weight loss) lead to more demand for chicken versus red meat, but often chicken production and vegetable production are intermixed (with a negative impact on biological safety). As well, the mixing of GM and non-GM foods has raised many concerns, and import restrictions exist in 35 countries.

Many feel that the current global food and agricultural system is presently in crisis and the future is likely to be worse. Some countries produce as little as 30% of their food consumption needs within their borders. Accordingly, recent global food price inflation has hit the poorest groups the hardest, especially as more countries limit trade export access to their domestic food production. While advances in agricultural technology will enhance production and reduce prices over the long run, many of the poorest social groups on both the production and consumption sides of the market equation continue to struggle – with the related social unrest and protests – bringing food riots and political instability. Prices are rising fastest in basic staples, thus giving the least flexibility to those with the most restricted diet…

The global anxiety over food supplies has led to recent stockpiling such commodities as wheat and other grains in other countries – thus driving grain futures higher, with less and less chance of a return to previous pricing levels – in contrast to the past. As global stocks-to-use ratios continue to decline, prices for grains will rise, especially with increased use for fuel production – for example, yellow corn and ethanol conversion.

While the North American economy is projected at about 3% annual growth for the next decade, Asian export levels are staying strong (China at 9% growth annually). But world consumption of many grain, oilseed and meat commodities has exceeded world production for almost a decade, resulting in a decline of commodity supply and the resulting rise in prices. The export markets of the US may soon be challenged by China and India, with their steady population and income increases.

Engineering

Long-term plans have been proposed for connected high volume northbound transportation corridors across North America, all the way to Canada. However, expedited border crossings necessary for effective commerce along these high-tech thruways continue to be complicated by national security issues, and the concept of one single North American border is still unrealized. The cultural push-back against globalization trends by national economies continues to escalate, thus complicating transnational engineering projects.

Engineering challenges often need more than engineering solutions. For instance, water is a good example…..By 2025, three billion people worldwide could be in a condition of water scarcity (compared to 700 million today). And there is the growth in popularity of crops like alfalfa, pecans, and sugar cane – all high water using crops. Dairy is also very water intensive and the growth of milk production has almost doubled in the past 15 years in a number of countries.

Irrigation pulls off animal, pesticide and fertilizer run-off out of rivers and other surface water…while deep well groundwater sources require additional resources for reaching dropping aquifers. Hydroponics is more conservative of water resources, but is also high tech and high investment (especially greenhouses) – and represents a significant culture change in many nations, as does the shift to organic fruits and vegetables.

Rural infrastructure challenges will continue. These challenges include costs of food marketing (transport to processing and packaging facilities), including poor roads, high fuel prices, and undependable transport. Local solar and wind might solve some energy problems… but transport, local energy production and wise water management will continue to be critical problems.

Environment

Global warming and climate change further aggravate the land production drop offs discussed earlier in this article. First, there is already global evidence of crop migration and shifts in growing patterns. It is well established that agricultural productivity improves as temperatures go from cool to warm, then decline as it moves from warm to hot. Accordingly, those countries nearer the Equator will suffer the greatest decline in productivity. Recent IMF studies look out to 2080 to show a temperature increase in equatorial farm areas of as much as 20 degrees Celsius with a doubling of atmospheric carbon dioxide – resulting in a drop in agricultural productivity of up to 36% in some countries. But it must be remembered that this is 70 years in the future and assumes no policy changes or new technological solutions. Crop migration and water utilization demands are already shifting old patterns of farming. And so will the threat of new diseases and new bio pollution. And finally, recent research into carbon fertilization suggests that more CO_2 in the atmosphere could significantly increase photosynthesis in crops like wheat, rice and soybeans, but this does not help sugar cane or maize.

It is highly possible that a World Environmental Organization similar to the WTO will be created within the next decade. For one, there will be 50 million environmental refugees worldwide in 2010 and 200 million by 2050. The re-insurance industry estimates as much as $300 billion in losses annually from

climate change damages to the environment. And weather index insurance is just getting started. The need is certainly there.

There are numerous changes from expanded ethanol production – new refineries being built close to fields are paying twice as much as traditional markets. With costs of grain rising, so does the cost of meat (tied to costs of feeding cattle, hogs and chickens), related products (eggs and dairy), and ingredients for other items such as corn syrup and starch. But urban restrictions on vehicle fuels will continue drive the demand for ethanol across the globe.

Although ethanol continues to produce animal feed as a by-product, it is difficult for animals to digest and needs starch supplement for effective nourishment. Corn yields per acre have continued to double each generation, and there is also the shift of land production away from beans, rice and barley.

Conclusion

Global cultural change is not a freestanding process; economic, technological, and governmental factors are involved as well. Agriculture provides a good medium through which to explore this process, as all humans need to eat, and the impacts of agricultural change are universal.

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POINTS FOR THE CLASSROOM *(send comments to forum@futuretakes.org):*

- *How will increasing cross-cultural interaction impact consumer food preferences and agricultural practices in your part of the world?*
- *Mack discusses the rapid growth of agricultural production scales, especially in the US and Canada. In which parts of the world, if any, will the family farm or other small farms survive, and why?*
- *Will pressures to increase agricultural yield per acre – to meet expanding global demand for food – lead to changes in consumer choices (for example, more vegetables but less meat)? What new agricultural practices and technologies might emerge to meet the increasing demand?*
- *Speculative investment is already under attack because of increasing energy costs, and as Mack observes, is also driving grain prices higher. What are the long-term implications to speculative investment itself?*
- *In what ways will increasing urbanization – and its impacts on family size – impact environmental degradation and resource consumption? In turn, what "wild cards" might impact the urbanization trend?*
- *Mack observes that "some countries produce as little as 30% of their food consumption needs within their borders." In the energy sector, present trends might be expected to favor energy-rich nations and regions, not only from an economic vantage point but also from a geostrategic one. Within the next decade, which nations and regions will best be able to leverage food as a geostrategic resource? Consider*
    - *Local climate change (e.g., desertification, soil erosion, falling water tables, changing temperatures and precipitation levels)*

- *Migration of arable land as a result of global warming*
- *Land use (e.g., cropland, ranch land, urbanization, biofuels production, soil mineral depletion from large-scale mono-cropping)*
- *Energy costs (for production and transportation)*
- *Disappearing pollinators*
- *Acceptance or non-acceptance of genetically modified foods*