The Importance of Convergence of Sustainability, Food Safety and Defense for Food Security

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The problems of food security, sustainability, and food safety and defense are not new, nor is the idea of convergence new. With more than 900 million people chronically undernourished, we are not on the verge of food crisis, we have been in one for a number of years. This is true for the number as well as percentage of the global population who do not consume sufficient calories.

Food safety is an historic problem with 5,000 people estimated to die of foodborne illnesses each year in the United States and 7,000 in the European Union. In 2010, the Pew Charitable Trusts estimated the annual health-related costs from foodborne illness in the United States at $152 billion. Food defense and the intentional destruction of crops, livestock and water supplies go back to ancient times.

What is new is the recognition that these problems are global and inevitably cut across national boundaries. The value of agricultural trade is ten times larger than it was in the 1960s, and the global population is much larger and more mobile. Natural-resource degradation and climate change are raising concerns that we are nearing a tipping point where disaster may be imminent if we continue on the same unsustainable path. In the *Wall Street Journal* in May, 2011, Peggy Noonan called unsustainability "the first buzz word of the 21st century." This recognition may have come about in any case due to concerns about population growth and climate change, but what really served as the wake-up call for food security was the political instability that grew out of the 2007/08 food-price crisis. This got everyone's attention and, on top of avian influenza and the financial crisis, raised

awareness beyond anything that advocacy had acccomplished that neglecting problems and doing the wrong things will eventually cost us, and that global disaster is a possibility. It is clear that decades of progress may be wiped out very quickly. The issues are now elevated, and rightly so, to be seen as threats to national security.

Global Food System

Why did this not happen earlier? It is noteworthy that the global food system has worked well for the majority of the world's population. For a long time, food production had a low priority; prices were declining, and agriculture looked like a sector that developing country governments and donors wanted to move out of, not invest in. This led to lack of attention, poor policy choices, and low investment in global agriculture. As a result, we have a longstanding problem, even without any new crisis of one billion chronically undernourished, plus perhaps a billion more with micronutrient deficiencies. About three-quarters of the chronically hungry are rural who produce food, either as smallholder farmers or landless laborers. Their crop productivity is low and they do not produce sufficient amounts or earn enough or enjoy access to a social safety net to get enough to eat. We should have tackled this much earlier and we didn't.

What comes next, however, makes the goal of global food security a lot more challenging, and *new* threats instill urgency into the importance of convergence. Solutions to food security have always required integration, which partly explains why progress has been slow. Now there is recognition that there is no alternative—addressing these global problems in isolation will not work. Solutions will come only through convergence of approaches, disciplines, and cooperation among people with diverse perspectives.

Interconnected Threats

The major threats are interconneted and they start with food production and the challenges of feeding a lot more people over the next 40 years (against a backdrop, remember, of 925 million people who are chronically undernourished). The rate of total population growth is steadily declining and we will reach, in the not-too-distant future, a point at which population will no longer grow. This will be a very important development, but, before we get there, the world will add another three billion people, requiring a doubling of food production. FAO's estimate is 70% more globally and 100% more in developing countries; other estimates, using somewhat different assumptions, come up with higher or lower figures, but all show a very serious production-increase challenge.

This will be the last time we need to double production, but how to achieve it? Global annual growth in wheat and rice yields have stagnated at 0.6% to 0.7%, whereas we need double that rate. Almost all of the increase in production will have to come from increased productivity, without adding more land. In addition, all of the population growth will be in developing countries, coupled with much greater urbanization. Incomes for most people will continue to rise and diets will change, with people eating a lot more meat, which will affect what is produced, how it is produced, and where.

We have had good experience with raising productivity levels in the past, but rates of increase are slowing. Recent estimates of the impact of climate change for the period from

1980 to 2008 indicate that global wheat output is lower by 5.5% than it would have been otherwise, and corn 3.8% lower. These may seem like relatively small amounts, but as current supply and demand are very tight for both crops, these losses of production are probably responsible for the current price spike.

Food production is consuming the world's resources at an unsustainable rate. It accounts for 70% of water use and 34% of land use. These investments of resources cannot continue at this pace while production is doubled. We are already using more than can be sustained, even without the additional requirements. Something has to change. In fact, a lot has to change. We need more production to resolve food security, particularly by poor families who raise food, but this has to be accomplished on a more sustainable environmental footing. The political reality is that without food security we won't make progress on sustainability. Resolving hunger is a requirement for environmental health, and sustainability is a requirement for achieving food security for the current population and for the larger population in the immediate future.

Food production is, of course, only one part of the food-security equation, but the challenges of production and the problems of the environment are very closely linked, as they are to income growth. Crop and livestock production, natural-resource degradation, food safety, climate change and political instability have mutual effects and none can be resolved in isolation.

Most emerging infectious human diseases are of animal origin and most of the microorganisms that cause foodborne illness come from animals. Changes in population density, changes in livestock production, and changes in land use have direct impacts on food safety. The inability of societies to ensure access to affordable food by all of its people leads to political unrest and social strife, which, in turn, can lead to severe disruption of agricultural production—as in Kenya in 2008—and to additional land degradation.

On top of that, agriculture contributes somewhere between 17 and 30% of greenhouse-gas (GHG) emissions, depending on what data are included in the calculation. Much of this comes from land-use change and from livestock. Climate change will reduce the rate of growth of agricultural productivity and, depending on the region, it may reduce productivity to levels below those of today. Climate change also is likely to affect the spread of disease, and to cause additional food-safety problems.

Future security threats will come less from foreign armies than from the unintended consequences of social, political, economic and environmental changes. Threats may also result by doing the wrong thing in one area, propagating risk in another domain or exacerbating the original problem:

- After forests are cut to make way for new crop production, new diseases may emerge from animals that spread within the human population;
- Climate change may cause greater variability in rainfall with more-frequent crop failures and more marginal land brought into production, releasing more GHGs;
- Biofuel production, designed to reduce oil imports may take land out of food-crop production, contributing to food-commodity price volatility, leading to political unrest that increases the price of oil;

- Some research results indicate that feeding the corn-ethanol byproduct, distillers dry grains, to cattle increases the presence of *E. coli* 0157 in the rumen, with food-safety implications.

Global Food Supply

The food-supply chain is truly global. Animal diseases cross national boundaries with ease, facilitated by trade, the movement of wildlife and personal travel. The connection between animal health, human health and environmental health is the central feature of emerging infectious diseases. The only way to prevent and control food-safety issues is to address the underlying causes and interactions. Land degradation and lack of development lead to migration, legal or otherwise, with its own problems and impacts. All of these issues cut across borders. They are global challenges that transcend social and political boundaries. None can be solved without the application of multiple disciplines.

The challenges can appear overwhelming. A 2011 report by the UK government, *The Future of Food and Agriculture*, states:

> *To address the unprecedented challenges that lie ahead the food system needs to change more radically in the coming decades than ever before, including during the Industrial and Green Revolutions.*

What happens now will have a huge impact on the future. We are at a turning point; can we transition into greater sustainability and security? The answer of course is "yes," but it will require doing things differently and recognizing the importance of convergence between these principle challenges to food security:

- sustainability as a basis for expanding production and reducing risks from climate change;
- managing food-safety risks; and
- defending the food supply.

Integrated Approaches

This, then, is the focus of the conference. We recognize that we cannot deal with the problems in isolation, and that integrated solutions need to be built around systems that include both science and society. Progress is, of course, very challenging, especially policy change that cuts across boundaries and involves stakeholders and policymakers with diverse values, perspectives and priorities. How might we address these challenges, frame the search for solutions and learn from experience? Everyone attending this conference has good ideas and insight from their own professional experience, and the speakers will, no doubt, address the challenges. We are not alone in placing emphasis on the converging themes of sustainabilty, development and security. Before offering some food for thought on organizing the convergence challenges, here are two examples from very different sources.

The first is from the European Union and its 2010 report *Europe 2020: A European Strategy for Smart, Sustainable and Inclusive Growth*, which recognizes the need for significant changes.

The crisis is a wake-up call, the moment where we recognise that "business as usual" would consign us to a gradual decline… This is Europe's moment of truth. It is the time to be bold and ambitious… Our short-term priority is a successful exit from the crisis… To achieve a sustainable future, we must already look beyond the short term. Europe needs to get back on track [through] three mutually reinforcing priorities:

- *Smart growth—developing an economy based on knowledge and innovation.*
- *Sustainable growth—promoting a more resource-efficient, greener and more competitive economy.*
- *Inclusive growth—fostering a high-employment economy delivering social and territorial cohesion.*

In brief: The need is for economic growth from knowledge-driven innovation, within a greener, sustainable environment that is inclusive and achieves social cohesion.

The second example is from PepsiCo and its 2009 Corporate Citizenship Report, *Performance with Purpose: Investing in Sustainable Growth.* It takes a roughly similar approach highlighting three inter-related themes:

- Human sustainability, focusing on healthy products;
- Environmental sustainability, focusing on water and greener production processes; and
- Talent sustainability, focusing on staff training and skill development within a diverse and inclusive culture.

In other words: Healthy products, from sustainable processes made by skilled and empowered people.

These are interesting formulations that, in many ways, embody what member states want FAO to achieve. Both represent similar themes on the value of what is produced, they acknowledge the centrality of environmental sustainability as a concurrent objective, and they include social concerns of inclusion, capacity and cohesion. How do they—and the forthcoming presentations at this conference—converge in meeting the component, inter-related parts of the food-security challenge? I would suggest three overarching principles.

Win-Win Solutions

First, we need to combine two or more simultaneous objectives. Forget trade-offs; we are looking for win-win or triple-win solutions that link drought relief, for example, to longer-term development, dealing with short-term disasters in ways that enhance long-term potential and reduce recurrent vulnerabilities. We need to increase production and productivity while increasing sustainability. This is very clear in the work on agriculture and climate change; we need solutions that increase production, reduce vulnerability to extreme weather events and mitigate the impact of climate change. This is the concept underpinning "climate smart" agriculture that has the objective of looking for solutions that simultaneously increase productivity, reduce vulnerability and increase resilience to

change, reduce or remove GHG emissions, and contribute to food security and national-development goals.

A related concept is "sustainable intensification," which is now the stated objective of FAO's work on agricultural production. Conservation agriculture is an excellent example that is, likewise, a central thrust of FAO's work. The main tenets are continuous minimum mechanical disturbance of the soil, permanent organic soil cover, and diversification of crop species grown in sequence or in association. Productivity should go up as moisture retention is improved, soil erosion diminishes, and the land (and its production) becomes less vulnerable to the impacts of rising temperatures and extreme weather events. Ideally, there is no trade-off; rather there are simultaneous benefits on several fronts: production, income, carbon sequestration, soil improvement, water management, decreased vulnerability. Similarly, integrated pest management seeks simultaneously to increase production while decreasing input costs and use of pesticides.

New approaches to food safety offer other examples. We need ways to intensify livestock production (particularly in developing countries) that reduce their environmental impact and also diminish entry of animal-origin pathogens to the food supply. The world is consuming increasing quantities of meat, which needs to be produced in ways that are sustainable, that diminish rather than increase GHG emissions, and that do not pollute water supplies or otherwise increase food-safety risks.

Convergence of Disciplines

The second area is the convergence of disciplines, integrated within systems-based approaches. Solutions that meet the simultaneous objectives mentioned above often derive from an ecosystems approach. Similarly, analyses at the landscape level expand our ability to see beyond the field level and integrate data to understand complex systems. The "One Health" paradigm is another excellent example, as it recognizes that emerging infectious diseases and many other threats can be dealt with only by integrating animal, human and environmental health. Food safety experts have taken a systems approach for a long time and HACCP[1] analysis is, at heart, a systems approach to hazard analysis. The evolution toward a more thorough risk-management approach from farm to table takes it further.

Convergence of Science and Society

The third theme is convergence of science and society. Addressing very challenging, complex problems requires empowering people and communities to understand the issues—and the science—to make informed and creative decisions: "Talent sustainability," if you will, on a large scale. No matter how converged the objectives, or cross-disciplinary the systems-approach, no one person can successfully implement solutions to complex problems if the definition of the problem varies among stakeholders. No single leader or institution is in charge of any one issue and the outcome will depend on a host of behavioral changes and cumulative decisions. There are, however, good examples of how science and society can converge for better outcomes, and we need many more.

[1]Hazard analysis and critical control points, see footnote, page 211.

My favorite example is the reduction of groundwater use for irrigation by farmers in India, through the Andhra Pradesh Farmer-Managed Groundwater Systems (APFAMGS) project. Groundwater, in small, hard-rock aquifers is being depleted at an unsustainable rate, as in many other parts of the world. The hydrology is well known, as are the problems associated with common-property resource management. The solution, implemented by a consortium of ten local NGOs—with support from FAO—covers about a million farmers in six districts, organized in village-based groundwater-management committees. The focus of the work is on participatory monitoring of hydrological data and crop-water budgeting, without any outside-imposed water-use targets or coercion, or, indeed, recommendation by outsiders that reduction of groundwater use is a goal.

The core concept of APFAMGS is that sustainable management of groundwater is feasible only if users understand its occurrence, cycle, and limited availability. To achieve this, the project adopted an approach aimed at demystifying the science by translating the concepts of hydrogeology and groundwater management to make them accessible to farmers, many of limited literacy. Based on this knowledge, the outcome has been crop diversification and changes in practice with increased income and reductions in groundwater withdrawal leading to improved (but often still elusive) sustainability of water supply. This process of adult learning for better farm management may sound obvious, but this may be the only example globally where it has led to reduced water use. Often, when water is used more efficiently, total usage goes up. This case is also a good example of converging objectives (less water use and more farmer income) and converging disciplines (hydrology, agronomy, economics, community organization). Its success, however, clearly comes from the convergence of science and society, equipping and empowering farmers and their communities to make better decisions.

Other examples come from ways that some countries have dealt successfully with HIV/AIDS, approaching it not as a complicated problem of limited resources for distribution of anti-retrovirals and healthcare, but as a complex problem where people and institutions can be empowered to come up with creative solutions to seemingly intractable problems. Brazil is a good example, highlighted in a Canadian study of how to improve its own health system. Brazilians could have framed the spread of HIV as a complicated problem with more or less foregone and dire conclusions (*e.g.* the drugs were too expensive to be given to all, so limiting choices had to be made; illiterate people cannot be expected to comply with a complicated regime of therapy; resources are very limited so the main focus should be on prevention rather than treatment). These, in fact, were the conclusions of a World Bank study. Rather than this approach, however, the country found ways to reduce the cost of drugs (breaking international patents); found creative ways to induce illiterate people to follow their treatment regimens; used informal networks to supply food and train people to care for themselves; and combined prevention as part of treatment and used treatment to encourage prevention strategies.

Food safety and defense, along with other security threats, require a greater appreciation by society of the science and, in turn, people's understanding of science-based risks. Risk communication is a big part of this, as are educational and training programs. This is a major challenge, especially where there is conflict over desired outcomes, where values,

perspectives and priorities differ among participants, all of whom need to be involved to achieve meaningful solutions.

Obstacles to Convergence

This leads us, in conclusion, to two significant obstacles to convergence. The first is the difficulty in designing meaningful indicators. Cross-disciplinary work and programs that are designed to achieve multiple objectives naturally increase the desire to have common indicators. This makes sense, but it has its own problems, both practical and conceptual. Are we measuring the right things? The head of the UK's Department for International Development defended its new emphasis on demanding impact measurement by opening with a question: Does emphasis on measuring impact . . .

> *. . . encourage us to indulge in a host of evils—to focus narrowly on the easy wins, to adopt 'one-size-fits-all' methodology, to take simplistic views of complex societies, and to mortgage long-term change for short-term gain?*

The second obstacle is the inherent difficulty in creating a shared understanding of the problems and shared commitment to solutions. The theme of the 1933 Chicago World's Fair was "A Century of Progress," with the motto: *Science Finds—Industry Applies—Man Conforms*. This was probably never true, but clearly is not operative today. It is very difficult to integrate science and society where values are in conflict, where experts from science or industry expect to dictate policy objectives or command conformity. There is, for better or worse, reduced faith in the ability of science to manage risks, coupled with increasing communication within communities of like-minded individuals who share strong beliefs and opinions regardless of the evidence. We do not have consensus on issues like GMOs, climate change, animal welfare, international trade and many others.

Nevertheless, convergence of sustainability, food safety and defense is essential. I hope that the concept of the importance of simultaneous win-win objectives, the integration of disciplines in a systems-approach, and the convergence of science and society will help us think through the issues that the NABC-23 conference speakers will present.

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