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**Fourth Minnesota Padova Conference on
Food, Agriculture, and the Environment**

Proceedings of a Conference Sponsored by
University of Minnesota
Center for International Food and Agricultural Policy

Universita degli Studi di Padova
Dipartimento Territorio e Sistemi Agro-forestali

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**SESSION III: THE FUTURE OF AGRICULTURE IN
THE U.S. AND E.U**

**PAPER 2: FUTURE INSTITUTIONAL STRUCTURE OF
AGRICULTURAL RESEARCH, EXTENSION, AND EDUCATION**

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FUTURE INSTITUTIONAL STRUCTURE OF AGRICULTURAL RESEARCH, EXTENSION, AND EDUCATION*

G. Edward Schuh**

I am pleased to be on the program for this fourth conference between our two institutions. I want to extend a special welcome to our colleagues from Italy. This is the kind of international institutional collaboration that will become increasingly important in the future. We are in a sense in the vanguard, thanks in part to the foresight of people such as Danilo Agostini, Phil Raup, and Vern Ruttan. We should give them our special thanks.

Trying to cover a subject as vast as that given me in such a short time is quite a challenge. I will make it manageable by limiting it for the most part to the theme of the session: The Future of Agriculture in the U.S. and E.U. Moreover, I do not pretend to have an answer, contrary to the implication of the title given me. Instead, I will mostly be discussing some issues, with a few suggestions on how we might proceed.

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My paper is organized into four main parts: (1) some background, to set the stage for what is to follow; (2) the importance of upstreaming; (3) broadening the linkages; and (4) multidisciplinary. At the end I will have some concluding comments.

Background

There are three important sets of issues I want to discuss as the basis for the more substantive parts of my paper, which are to follow. The first is the state of the world food situation. The second is the problem of rural development. And the third is the general equilibrium effects of agricultural modernization. These each help set the stage for discussing the kinds of changes in the structure of the agricultural science and technology establishment we should be thinking about.

The World Food Situation

There are many in today's world who argue that the world food problem has been solved. In my view that represents a dangerous failure to understand the world about us, and one that can create serious global problems in the not too distant future. An ample discussion of the issues could be a paper in itself. However, I will merely point to some of the main issues.

First, the potential of the miracle rices and wheats of Green Revolution fame is just about exhausted. The remarkable increases in yields for these two food crops - the two most widely consumed in the world - were based on a rather specific

breeding technique. They involved dwarfing large vegetative plants with relatively low yields of grain and replacing them with semi-dwarf plants with high yields of grain.

An important feature of this process is that it has a biological limit. A plant can be made only so short (or small). That limit for all practical purposes has been reached. For example, the highest yield for rice realized at the International Rice Research Institute was attained back in 1968. Nothing with a higher yield has been reached in the interim, despite the improvements in palatability and in resistance to disease and pests. The biological or physiological limit has been reached.

Similarly, the geographic spread of these varieties is also nearing its limit. The adoption process is out on the flat part of the ogive curve that describes the adoption of new innovations.

The potential threat to the world food problem arises from the fact that there is nothing in the wings that appears likely to replace this technological breakthrough as a source of increased output. Thus, we face a period of stagnating growth in food grain output if nothing else comes on stream.

Second, this problem is complicated by the fact that the growing capacity for graduate education in the agricultural sciences and for agricultural research, that was coming on stream in the developing countries at the end of the 1970s, has been

decimated by the economic crisis of the 1980s. To further compound the problem, the support for the colleges of agriculture and for agricultural research in the United States is waning. This is a reflection of the failure to understand trends in world agriculture, and of the severe budget pressures U.S. land grant colleges have been facing. The U.S. system, together with that in the European Union, have been an important source of basic knowledge for global agriculture.

Third, the promise of biotechnology has yet to be realized. As long as I can remember observers of this potentially important research innovation have been saying that the real breakthroughs are just ten years away. I heard such a statement once again just about a year ago.

To conclude, we need a renewed commitment to basic research in the agricultural disciplines, and to the support of agricultural research and the basic agricultural sciences. The political process is driving us the other way, however.

Rural Development

The agricultural scientific establishment has tended to badly neglect the human side of agriculture. The per capita incomes of rural and agricultural people have traditionally lagged significantly behind those in the urban sector. This is about as close to being a universal proposition as one finds in economics, and is due in large part to the need to transfer labor out of agriculture as economic development

proceeds. Moreover, traditional commodity programs, such as those in the European Union and the United States, have failed to address this important problem. To the contrary, the income transfers from these programs have tended to go to the more well-to-do, with the result that the income distribution of rural people has become more highly skewed. In addition, these programs have exacerbated the labor adjustment problem since they have made it possible for the larger farms to buy out the smaller ones.

The income problem of rural sectors is not rooted in agriculture, and this is an important point. It is rooted in the failure to invest in the human capital of rural people, and in the physical infrastructure that serves the rural sector. It is also rooted in the large subsidies for the agglomeration of economic activities in urban/industrial centers. The challenge is to level out or eliminate these subsidies, and to undertake activities that will create nonfarm jobs in rural areas.

General Equilibrium Effects of Technical Change

Perhaps one of the most neglected aspects of agricultural modernization and development is the tendency for most of the benefits of technological change to be realized in the form of general equilibrium effects. The growing neglect of agriculture as an element of economic development is due in large part to the general neglect of this important relationship. Technical change contributes to economic development by reducing the cost of food, which in turn is equivalent to an increase in the real

income of consumers. When introduced into the production of export commodities, it earns foreign exchange and this in turn helps to finance a higher rate of economic growth. If the trade effects are large enough, they can also result in a rise in the real value of the exchange rate, and these effects are also widely diffused in the economy. They can also result in an increase in real per capita incomes.

Finally, food is a wage good. If the real price of food declines the country will become more competitive in international markets because it is possible to raise real wages without an increase in nominal wages. This is another general equilibrium effect.

In summary, the importance of agriculture has little to do with the share of the GNP generated by the agricultural sector, or the share of the labor force employed in agriculture. It has almost everything to do with the fact that everybody consumes food, and that agriculture tends to be a tradeable sector.

The Importance of Upstreaming

Specialization among the agricultural sciences started when the agricultural disciplines were primarily applied sciences. Agricultural professionals did not have to have a great deal of depth in the sciences, although they certainly had to be familiar with the scientific method. Moreover, they could be on or close to the frontier of science while at the same time applying the knowledge from that frontier to the

solution of practical problems on the farmers field.

This was true of most of the agricultural disciplines. It was also true of researchers, those who lectured in the classroom, and those who engaged in extension activities. One of the most famous animal scientists at the University of Minnesota, Professor Bos, was at one and the same time on the frontier of knowledge in his field and also one of the University's most effective extension people.

Over the years the incredible growth in science and the accumulation of knowledge has pushed the frontier of science further and further away from the practical problems faced by farmers. This has made it more and more difficult for the members of disciplinary departments to be on the frontier of knowledge and at the same time extend their knowledge to farmers. We have recognized this by the development of extension specialists.

The stresses and strains on the system continue to be great, however. If the new knowledge being generated on the frontier of knowledge is to be useful to the solution of practical farm problems, the research scientists in the system have to be working on the frontier as well.

The Department of Agricultural Economics at the University of Minnesota recognized this problem some 20 years ago. They converted themselves into a

Department of Agricultural and Applied Economics, and filled what was becoming a large gap in the economics discipline at the University. The Department of Economics was becoming more and more specialized in the basic economic discipline, and neglecting the applied part of its discipline. The Department of Agricultural and Applied Economics helped to fill the gap. At the same time, many people would argue that it has better served the agricultural sector.

My thought is that the other agricultural disciplines should be doing the same thing. They should be upstreaming their academic perspective, thus picking up more and more of the basic disciplines of their parent disciplines and allowing those disciplines to move further and further towards the frontier of knowledge.

Unfortunately, the agricultural disciplines tend to resist the movement in this direction. Their proclivity is to remain as applied departments, even though they themselves become more and more specialized as they adapt to the changing knowledge base on which they must operate. One consequence of this conservatism, for example, is that the biotechnologists in the Colleges of Agriculture tend not to be on the cutting edge of science in their field. Those who are on the cutting edge go into the medical school, the colleges of biological sciences, and so on. That is how the Colleges of Agriculture tend to fall behind in terms of disciplinary respect, and fail to serve the agricultural sector as effectively as they might. That tendency is in part at the roots of the decline in political support for the traditional agricultural establishment.

Bringing about this upstreaming is not easy from an administrative standpoint. For one thing, in academia the scientists tend to have tenure. Motivating them to change their perspective and to advance the level of their skills is not always easy. Similarly, universities tend to underinvest in their own human capital, in part because the economics of investing in their human capital has changed, with the costs of taking sabbaticals rising sharply. Finally, moving into the new fields generally entails squabbles over turf. The university structure will generally resist the desire of the agricultural disciplines to upstream themselves.

The current budget pressures should create enough internal pressures within the university to provide the incentive to bring about this restructuring of the colleges of agriculture. Nothing less than a change in the total structure will make possible the kinds of changes needed. But the advantages of crises is that they can provide the incentives to help bring about such changes.

In closing this section it is worth noting that the agricultural science and technology establishment is subject to significant stresses that go in contradictory directions. There are those of us who press it to go further upstream and to integrate itself more fully into the basic sciences. At the same time, however, those driven by a concern for sustainable development are driving the establishment towards a more applied bent. The political pressures come from different sources, and with varying degrees of political strength. Sorting out these pressures and translating them into

effective programs is one of the major challenges of the day.

Broadening the Linkages

There are two important dimensions to this set of issues. Time limitations require that I treat each of them only cursorily.

The first is the need to broaden the international linkages of our agricultural scientists, both of those who do our resident instruction and those who consider themselves primarily researchers. A larger and larger share of agricultural R & D expenditures is spent outside of the United States and the European Union. If we are to capitalize on the knowledge generated from those expenditures we need to develop true scientific linkages with scientists in other parts of the world.

The fact that so many of the international linkages we have, at least in the United States, have been established by means of our foreign aid programs has given us an inappropriate and short-sighted perspective on these relationships. We tend to view them in a patronizing way, with the general view that we are in the business of helping the scientists in the other countries and that we have nothing to learn from them. Instead, we should be establishing true collaborative arrangements, with the idea that we have as much to gain from them as to give.

This is as much an issue of mentality as it is structure. However, we need to

worry about the structure as well. We need to design structures within our domestic research and teaching institutions that drive us to programs of mutual collaboration on important problems.

The second sense in which we must broaden our linkages is to engage a wider range of disciplines from across the university. This is needed as we think about agriculture in the narrow sense, and the need to generate new production technology for that sector. It is especially needed when we address the problems of rural development.

The starting point in thinking about rural development is to move away from the idea that we can think about agriculture and rural development as something separate from the rest of the economy. This common view is counterproductive, and causes us to fail to address the main issues.

A useful starting point in thinking about this issue is with our own discipline, agricultural economics. Policy work cannot, and should not have in the past, concentrated only on the design of new, more efficient agricultural policies. We should have been integrating the political sciences with economics, and with sociology, to develop a broader perspective of political economy. This is a specific case in which specialization within a discipline, despite the many advances in knowledge it has brought, has not made us any more effective in bringing about

change in policy.

The more general set of issues is somewhat different, however. If we are to address the problem of rural poverty we must give more attention to the problem of rural development. But as I noted above, to do that we need to address the full range of economic development problems. We need to focus on the other sectors in the economy, on the biases built into our physical infrastructure, on the large subsidies that cause per capita incomes in urban agglomerations to grow faster than those in the rural sector, and on the mechanisms that lead to greater investments in the human capital of rural people, including health care, education and training, and the design of more effective institutional arrangements. In effect, we need to link the full range of academic disciplines within the university to the general process of economic development.

This perspective is especially important to the extension service, which should have as its mission to promote the economic development of the general economy in an efficient and equitable way. This again requires a significant change in the structure of the university, and new perspectives as we define our mission.

We have a new approach to these problems here at the University of Minnesota. Pat Borich, Dean and Director of the Minnesota Extension Service, has placed program directors in some thirteen academic units scattered across the

University. The idea is that they will develop programs that mobilize the academic talent in these units and link them to the very effective delivery system we have across the state. We are still feeling our way in developing these programs, but the potential is quite great. What we will eventually need is a full articulation of this new perspective on the part of central administrators, and the design of incentive systems for the rest of the university that will provide the motivation for professors in those other units to actively engage in the solution of problems in the society.

Multidisciplinarity

There was a time when colleges of agriculture were effective multidisciplinary units. Prior to the time knowledge had become so specialized it was easy to cooperate and collaborate across disciplinary lines. That is no longer possible. Not only has the language become too specialized, but academic departments have surrounded themselves with walls. To further complicate things, the growth of peer-reviewed processes for the funding of research from the federal government has greatly weakened the power of academic deans and department heads to bring about interdisciplinary cooperation. Faculty are no longer dependent on their academic administrators for the funding of their research and have in the process become academic entrepreneurs with a great deal of independence.

The solution to this problem is in part the establishment of problem oriented, multidisciplinary centers of excellence. While also making the management of the

faculty somewhat difficult, this approach has the virtue of bringing together scientists from a broad range of disciplines and at the same time providing them with the motivation to collaborate together. With a well-defined set of problems, and with leadership that can effectively articulate them, such centers also have the potential for attracting funding.

The University of Minnesota is still finding its way in establishing and managing such centers. We have a number of them in the Humphrey Institute, each with a problem focus. The College of Agriculture, for its part, has a Swine Center and a Tourism Center, both of which have their measures of success. The College of Agriculture also has a relatively new dairy program that is also having a significant measure of success.

As should be clear, these Centers and programs significantly change the structure of the university. They may eventually pose a threat to the traditional academic departments, and they always run the risk of becoming excessively oriented towards the extension side and to neglect the research mission. The institutional arrangements developed to manage these centers will be the critical factor in determining their success.

Concluding Comments

My perception is that the agricultural science establishments face threats in

both the European Union and in the United States such as they have not faced in a long time. Budget pressures are severe, the political support for agriculture is declining, we have unlearned much that we once knew about agricultural development, and at least in the U.S. we are rapidly learning that much of the support for science and technology was once driven by the exigencies of the Cold War. With the cooling and possible end of that War the support for science and technology may have already reached its peak.

The drive for international competitiveness may at some point in the future renew this support. Independently of such a development, however, we still need to rethink the structure of our agricultural science establishment, primarily in reflection of changes and developments in the sciences on which our disciplines are based, and of the need to be more efficient and effective in the delivery of our services. We have many challenges before us.