Impact of New Technology on Food and Agriculture

Walter J. Armbruster[1] Presented at the PECC General Meeting, 28-30 November, 2001in Hong Kong.

I will focus my comments on some of the socioeconomic aspects of policy issues involving adoption of biotechnology in the food system.

Science, Benefits and Risks

James Bonnen identifies two types of risk analysis relevant to biotechnology. The risk analysis generally referred to by the scientific community involves specific products and their potential harm, while little attention has been paid to the broader context of risk analysis related to what is socially acceptable (Bonnen, p.14).

Bromley argues that ...
and the necessity of those technologies.

GMOs. The scientific community is convinced of the benefits of such technology and gives assurances about the lack of known risk. Others dismiss their assurances. But those opposed believe that
affects can materialize, imply that there are no reliable means whereby the plausible risks can be

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measured and assessed.

Industry and scientific representatives in favor of biotechnology argue for policy decisions to be based on the logic and evidence of

various interest groups. But Bromley (p.8) believes that

straightforward as the technological advocates would wish. Most profoundly, skepticism about the manifold wonders of GMOs will not be resolved by the display of data about the lack of proof of risk.

argues that it lies in

In part, the conflicts involving food safety issues related to biotechnology products revolve around the approval process. Is mandatory or voluntary product testing involved to get product into the market? The U.S. policy allows product to be introduced under the assumption that product characteristics are not changed just because biotechnology techniques are used to produce them. The Food and Drug Administration (FDA) now proposes to require submission of data from voluntary testing of products as the basis for obtaining preapproval to market the product. This data is approved by FDA to obtain the authority to market the product. If changes in product characteristics are known to be linked to potential problems such as carcinogenicty, then mandatory testing is already required for approval. Other countries also have mandatory test protocols. A group of nine science and policy experts, under the auspices of the Council for Agricultural Science and Technology (CAST) have just released a report which recommends that the U.S. Food and Drug Administration (FDA) finalize its

proposal for a mandatory, pre-market notification in lieu of the present policy of voluntary consultation for all food products of agricultural biotechnology
the public
by the task force members that this increased transparency of the regulatory process would enhance consumer confidence in the resulting food products.

A major issue for biotechnology products is that those introduced to date have no visible consumer benefits, rather they enhance input supplier, producer and marketing firm profitability. Hence, consumers have reason to be concerned about any possible food safety risks, however minor they may be. Many observers believe that concerns about food safety from biotechnology products will largely subside when
consumer benefits are made available. Examples might be foods that protect against heart disease, and other chronic illnesses. More specific to developing economies in the Pacific Region is the introduction of rice containing higher levels of vitamin A, though still sometime in the future.

The other major issue involves environmental risks and benefits from biotechnology products. These are not widely understood and it is argued by some that they are not well established scientifically. Ervin, et al. (p.6) argue that
(transgenic) crops have grown much more rapidly than our ability to understand or appropriately regulate.
transgenic plants results in risks for the environment and for the agricultural industry. And the

environmental benefits of reduced insecticide and fertilizer use are not clearly evident to the public.

Important socioeconomic issues include differing perspectives on biotechnology. Are the risks in biotechnology socially acceptable? This is an area driving much of the controversy around biotechnology, although most of the research emphasis has been on the evaluation of known risks in a biological or environmental context. The right to know argument for disclosure of the presence of biotechnology ingredients in a food focuses on developed country consumers choices to accept or reject the products, perhaps a less valid view for developing countries where food is in chronic short supply. Socioeconomic differences are critical to understanding concerns that must be dealt with for biotechnology products to be accepted.

Biotechnology in the Pacific Region and Developing World

A fundamental challenge facing the PECC region in the longer term will be raising food system productivity to keep pace with population growth and rising affluence. Only about one-fifth of the increased grain production needed is likely to come from expanding land under cultivation. Land area is particularly constrained in the Asian PECC economies. Limited potential for expansion of land resources will mean that technology must play an important future role in raising farm level yields, increasing consumer choice and attaining better nutrition levels *(Pacific Food Outlook - 2001,* p.10).

However, technology advances alone will not end hunger which is primarily attributable to poverty and unequal distribution of income. As Bromley notes, it is not

suppose that the introduction of GMOs will induce long-overdue institutional transformations in agricultural policies that discriminate against farmers for the benefit of urban consumers in the lower latitudes...

policy in the developing world, and perhaps technological advances only relax the pressure for much needed institutional reform.

Proponents argue that biotechnology can help meet agricultural production needs of developing countries, enabling farmers to be more efficient without significantly changing their farming practices.

Pinstrup-Anderson (p.9) argues that

driving force for broad-based economic growth and poverty alleviation. A healthy agricultural economy also offers farmers incentives for sound management of natural resources. Accelerated public investments are needed to facilitate agricultural and rural growth... These investments must be supported by an enabling policy environment, including good governance, as well as trade, macroeconomic and sectoral policies that do not discriminate against agriculture. ... Public investment in agricultural research that can improve the productivity of small scale farmers in developing countries is especially important

Pinstrup-Anderson is particularly concerned that while the public sector and philanthropic

institutions have supported conventional crop research in developing countries and made improved seed available for multiplication and distribution, this practice changed when improved material was subjected to breeders

property rights often do not extend beyond the initial release. Once acquired, seeds can be reused by farmers without further payment even though, in the case of hybrids, it would greatly reduce yields. However,

undertaken by private sector firms. ... The transnational life science companies protect intellectual property rights through patents that extend beyond the first release...

Pinstrup-Anderson notes that little private sector agricultural biotechnology research has emphasized developing country food crops other than maize.

His colleagues, Pardey and Beintema, are concerned that while intellectual property rights provide incentives for innovation,

proliferation of patents makes it increasingly difficult for public institutions and private start ups to be active participants in biotechnology research . ... As patenting becomes more prevalent, the number of separate rights needed in producing new innovation proliferates. ... Further, rights to intellectual property are confined to the jurisdictions in which they are granted

particularly important in less developed countries which may have need for new technologies.

Technology Transfer and Sharing

Pardey and Beintema note concern that the spread of patents internationally may

agricultural research that is conducted in, or of consequence to, developing countries. ...For example, the recent innovation involving vitamin A in rice reportedly required permission for more than 70 patent rights. The well-publicized donations of their relevant technologies by major corporations left a strong impression that enforcement of large numbers of crucial patents was being relinquished in favor of the poor in developing countries. In fact, in some major rice consuming countries, there are no valid relevant patents. There are very few, if any, in the countries where most poor, malnourished consumers reside.
potential income (p.21).

The significant shift away from the public research, education, and extension approach long applied to discover and adopt new technologies through the land grant university system in the U.S., as well as through various institutional structures in other countries only exacerbates the problems. Increasing private sector funding and dissemination of research results through patented products has resulted in a short circuiting of the education and extension functions that created a better understanding of previous new technologies and allowed objective assessment of their impacts before widespread adoption. The private sector model puts a premium on secrecy. Then, once a product is ready for marketing, its introduction is through a sales rather than in an educational approach. I believe that this change may be at the root of much of the difficulty in obtaining acceptance of biotechnology products.

Given funding situations and the potential gain from private sector development, contractual property protection has contributed significantly to the development of current biotechnology.

Increasing intellectual property protection has resulted in significantly increased private sector research in the pursuit or profits supported by intellectual property rights. At the same time, the industry has significantly centralized with a few multinational firms leading the effort. According to Barton, publicly-funded research may need to alter its focus to compliment work carried on the private sector. The private sector strength lies in research on crops exported to developed countries and probably in adapting major crops to middle income farmers to use in middle income nations. The public sector will be responsible for the poorest farmers and must be sensitive to environmental issues. These important roles for the public sector can be complimentary to private sector activity.

advanced technologies, the publicly-funded agricultural research community must also develop an effective approach to cooperation with the private sector in research and product development

developing countries

constrained. Legal costs and transaction costs for attempts to navigate through the patent tickets are mounting. ... Both public sector institutions and private sector firms are spending valuable resources to solve intellectual property problems that could otherwise be used to guarantee the environmental and health safety of their innovations

Graff and Zilberman (p. 1) further argue

rights, significant improvements in freedom-to-operate can be achieved regardless of the state of

patent reform.

for agricultural biotechnologies to reduce transaction costs and other market failures that hinder the exchange of IP.

The approach of an intellectual property clearinghouse could overcome a problem identified by FAO

be potential for companies as well as public research institutions in developing countries to harness technology through strategic alliances with corporations in developed countries, while avoiding the exploitation of public research for the benefit of private corporations. With proper ethical commitments, corporations could help developing countries to use this technology (FAO, p.16). Encouragement of technology transfer and sharing of intellectual advances are critical to the successful adoption of new technologies, particularly biotechnologies in the agricultural and food sectors. The complexity of patenting systems, their there applicability to individual countries and the difficulties of tracking patents, even within countries, requires innovative institutional arrangements such as the proposed intellectual property clearinghouse.

In closing, I believe that it is possible, and even probable, that workable arrangements will be developed between public and private sector participants in biotechnology research and application to significantly improve food security, safety and quality in the coming years.

References:

Armbruster, Walter J. 2001. Biotechnology Policy Issues. Paper presented at Preconference

Workshop, Agricultural Biotechnology: Markets and Policies in an International Setting. January 22, 2001. Adelaide, South Australia: Australian Agricultural and Resource Economics Society.

Barton, John H. 1999.
Washington, D.C.: IFPRI.

Bonnen, James T. 2000. The Transformation of Agriculture and the World Economy: Challenges for the Governance of Agriculture and for the Profession. Elmhirst Memorial Lecturer. Berlin: International Association of Agricultural Economists meetings.

Bromley, Daniel W. 2001.
Necessity in Science Policy and Public Opinion. *Choices*, Second Quarter 2001.

Council for Agricultural Science and Technology 2001. Evaluation of the U.S. Regulatory Process for Crops Developed Through Biotechnology. Issue Paper No. 19. Ames, IA: CAST.

Ervin, David E., et al. 2000. Transgenic Crops: An Environmental Assessment. Washington, D.C.: Henry A. Wallace Center for Agricultural and Environmental Policy at Winrock International.

Food and Agricultural Organization of the United Nations. 2001. Report of the Panel of

Eminent Experts on Ethics in Food and Agriculture. First session, 26-28 September 2000. Rome: FAO.

Graff, Gregory and David Zilberman. 2001. Agricultural Biotechnology. *IP Strategy Today*. No. 3-2001, Pgs. 1-11.

Pacific Food Outlook 2000-2001. 2000. Singapore: Pacific Economic Cooperation Council.

Pardey, P. and Niemke Beintema. 2001. Slow Magic: Agricultural R&D, a Century After Mendel. Food Policy Report. Washington, D.C.: International Food Policy Institute.

Pinstrup-Anderson, Per. 2001. Biotechnology. Markets and Policies in an International Setting. Australian Agricultural and Resource Economics Society.

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