How the Agenda is Set

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The question of how the biotechnology agenda is set has most interest when the outcome of that agenda-setting is in question. To ask what agricultural biotechnologies might be beneficial and how their development and implementation might be expedited supposes that the existing institutions and incentives are somehow inadequate or unreliable. This brief discussion considers how decisions about new technologies for food and fiber production and processing are made and at what point, if alternative outcomes are desired, intervention might be contemplated.

THE TRADITIONAL PARADIGM

In the traditional paradigm of economists, the marketplace is both the instigator and the arbiter in the contest among new technologies. Unless supplying firms profit, and consumers find utility in the new technology or its products, there can be no success. Questions about quality, safety and efficacy are largely answered in the market exchange, with oversight by public authorities in some cases. Technological innovation is induced by economic signals as embodied in the relative costs of inputs and prices of outputs. Induced innovation can explain the transformation of American agriculture by observing that the post-World War II economic expansion made labor relatively more expensive compared to other major factors of farm production. Consequently, technologies were developed that substituted for labor with the use of capital in the form of purchased inputs such as large-scale machinery and later through organic-synthetic pesticides. In the traditional view, market signals set the agenda—from start to finish.

As with most constructs of economic theory, reality is more complicated, particularly in the case of the agricultural sector. First, there is significant government intervention in agricultural markets, interventions that intentionally distort market prices. For example, U.S. commodity subsidy programs inflate land values because acreage set-asides artificially restrict the supply of land and so raise its price relative to other factors. As a consequence, technological change that saves land is induced, again reinforcing the capital-intensity of production. Second, much agricultural research and development (R & D) has had "public good" attributes, that is, displayed characteristics that make private sector participation unlikely even though societal benefits could be

had if a technology were to become available. So, for example, a technology such as contour plowing was developed largely by the public sector because the benefits from its adoption could not be restricted to participants in a market transaction. Anyone driving by a contour-plowed field could figure out how to implement the technique without paying the originator for the knowledge. Whether there are more such public good opportunities in agriculture than in other sectors is a good question, but it has historically been the case that significant public sector resources in the land-grant colleges and U.S. Department of Agriculture (USDA) have been devoted to both basic and applied research. Third, not all relevant aspects of agricultural technologies are reflected in market prices—another familiar form of market failure. Environmental effects and human nutritional implications are two well-known examples. Fourth, the distribution of the costs and benefits of a new technology follows market signals, implicitly valuing welfare equally across individuals. So, for example, from the market's perspective, a dollar of profit to a small farmer is the same as a dollar of profit to a large farmer.

The existence of such market distortions and failures has contributed largely to the emergence in public dialogue of the "fourth criterion" in assessing agricultural biotechnologies. In this conception, socioeconomic and environmental impacts of a technology or its products are evaluated alongside its quality, safety and efficacy. Manifestations of the significance of the fourth criterion, particularly in the debate over the use of bovine somatotropin (bST), have been seen in the U.S., in the European Union and in Canada. According to the May/June 1994 issue of the *Agbiotech Bulletin,* the Canadian House of Commons agriculture committee may "recommend the federal government conduct social/economic/environmental impact studies on all new biotechnology products before they come up for public scrutiny and that biotech companies be charged with the job of getting out information." Such recommendations essentially represent calls to modify the way the agenda is set, to explicitly consider non-market aspects of technology adoption and use.

Not surprisingly, it is generally easier to agree on the need to the change the agenda-setting process than on the definition of a beneficial outcome. Here, the discussion concentrates on how the agenda is set in order to identify possible forms of intervention or modification with the ultimate goal of changing outcome. The agenda-setting process can be altered *ex ante* or *ex post,* that is, before development choices are made or after a technology has emerged but before it appears on the market.

EX ANTE INTERVENTION

The question of how choices are made is a fruitful one for discussion, especially as an alternative to the "Monday morning quarterbacking" that currently characterizes the debate over agricultural biotechnology agenda-setting. In addition to signals sent by the market, R & D directions are determined by the

opportunities afforded by the scientific frontier and by a host of non-market signals. External private market signals to researchers are accompanied by external signals from public agencies (as through funding or regulatory decisions) and by internal values and characteristics of researchers. The role of the external market signals has been extensively considered, as discussed, but less attention has been paid, in agriculture anyway, to the public and internal signals that determine problem choice.

The question of how a researcher's experience, background and competence affect problem choice is complicated. I recently considered the case of agricultural economists, starting from the intuitively appealing premise that generational change in the population of scientists will have an impact on the discipline's research agenda (Offutt 1993). As was typical of most agricultural science disciplines, the agricultural economics area was comprised of white men from farm backgrounds who were trained at land-grant universities. However, the post-World War II generation became more diverse: more women and minorities from suburban and urban backgrounds educated at land-grant universities, as well as liberal arts colleges and private universities. Without going into depth about the analysis, suffice it to say that I found it worthwhile to explore the implications of changes in characteristics of agricultural scientists at a time when the relevance of the traditional research agenda is being challenged.

To turn to the question of public sector signals, it is perhaps ironic to note that the public agricultural research agenda-setting process is the envy of some other parts of the scientific community. The multilayered system of priority-setting that links state and federal efforts is seen as transparent and participatory. However, this admiration is not universally shared. As but one example, consider the animated dialogue between advocates of sustainable agriculture and the managers of USDA's Competitive Grants Program—the National Research Initiative (NRI). Considerable effort by both groups has been devoted to modifying grant proposal review to reflect the goal of sustainability—an effort which is in no small way complicated by the lack of a working definition of the concept. And, in starting a major study, the National Research Council's Board on Agriculture has expressed its concern for the future effectiveness of the land-grant colleges of agriculture, a very large component of the public system. These process-oriented efforts more generally reflect a concern about the nature of the outcome of agenda-setting for agricultural biotechnology and agricultural research.

EX POST INTERVENTION

It will be impossible to eliminate controversy over whether a technology is beneficial or not. Consequently, *ex post* (post-development, pre-market) intervention will remain a live, if costly, option. To return to the traditional paradigm, economic theory says that such intervention in the market is

inappropriate as a means of achieving non-market goals. Instead, non-market tools should be employed such as compensatory payments to those who might be adversely affected by a market outcome. If the problem were perceived to be uneven income distribution among farmers, which might be exacerbated by the adoption of a new technology, then the most efficient intervention is a transfer payment from the public treasury directly to poorer farmers. This approach recognizes that, while technologies have undeniable positive and negative socioeconomic impacts, it is hard to "reverse-engineer" the development process to predict the outcome of technology adoption well enough to allow control from the start. Sometimes even the best intentions go awry. To draw an example from outside agriculture, consider the development of labor-saving devices for housework like the vacuum-cleaner, which, one might have supposed, would have freed women from having to spend so much time cleaning. Alas, there is considerable evidence that has not been the case.

Ex post intervention potentially involves acting on the fourth criterion, moving beyond a regulatory consideration of quality, safety and efficacy. Implementation can be tricky, however. What actions would be taken—prohibition of a technology or restrictions on its use? Imposition of taxes or subsidies? Who would be empowered to take these actions—appointed or elected officials? Permanent civil servants? Citizen groups? Given that intervention of this nature would be unprecedented, the question of how, or perhaps whether, existing rules and institutions could be modified to cope is a good one to ponder.

CONCLUSIONS

In considering the agenda-setting process for agricultural biotechnology, the initial question of problem definition seems key. How are needs identified or perceived? Given the complexity of the food and agricultural system, how can the contributions, and limitations, of numerous perspectives be appreciated? The advent of biotechnology has hastened the day of reckoning by accentuating the linkages among farming practices, the natural resource base, food processing, and consumption requirements and desires.

The most pressing need is to be more analytical about understanding how technologies evolve. This process is not strictly a function of personalities; there are behavioral patterns that can be understood, and presumably modified, just as there are policy instruments in place or on the shelf that affect market and non-market signals. Any reconsideration or redesign of the process has to accommodate the continued prospect of argument over the beneficial nature of new technologies because benefits will always be accompanied by risks and costs. As a practical matter, we will likely not have the option of repeatedly denying use of any technology that adversely affects one or another member of society. Political judgments about acceptability will have to be made. This is necessarily a messy process and perhaps one unfamiliar to agri-

culturalists who have enjoyed 100 or more years of relative consensus about what they do and why. Institutional innovation, not personal attack, would seem to be the order of the day.

REFERENCES

Offutt, S.E. 1993. Ensuring Hybrid Vigor in the Agricultural Economics Profession. *Amer. four, of Ag. Econ.* 75:1150-1154.