Technology, Technical Change and Public Policy: The Need for Collective Decisions

by

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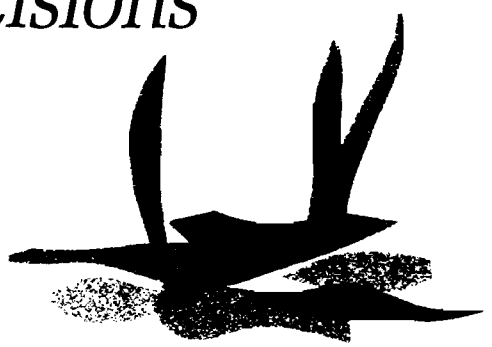

Few issues have dominated public discussion in agriculture quite like bovine somatotropin (bST) or bovine growth hormone. The controversy over bST might not be so significant were it not bound up with broader concerns about technology and technical change. What then is the role, in a "mostly" market economy, for explicit public policy regarding technology and technical change?

Technical change usually permits familiar tasks to be completed at lower out-of-pocket costs or allows tasks heretofore impossible to be undertaken. Notice that bST entails both kinds of technical change; new tools, knowledge, and institutional arrangements allow creation of a new product that makes familiar activities (cows producing milk) more productive. With each cow producing more milk, the nation's milk needs can be supplied with fewer cows, less land, and fewer people in the dairy industry.

This is the dilemma. If you are young, aggressive, and business oriented with farm management books on the shelf and a computer on the desk, you will likely insist it is "foolish to stand in the way of technical change." In contrast, if you are dedicated to a rather more tranquil life, and do not see any direct benefit to you from bigger and bigger farms, then you may doubt the advantages of the "technological treadmill." In your case, the new technology threatens your economic well being. Obviously technical change holds very different implications for the two kinds of farm families. Where you stand on technology and technical change depends on where you sit.

At issue here is the need for —and the wisdom of— collective decisions about future technical paths.

At issue here is the need for—and the wisdom of—collective decisions about future technical paths. For some, the idea of technology policy conjures up immediate fears of dreaded government regulation. However, many government policies and programs *already* have a significant impact on the nature and direction of technical change. Therefore, while the idea of controlling technical change excites controversy, people must recognize that governments already aggressively support certain technical changes that happen to reflect accepted political norms and economic interests. For instance, millions of dollars of public funds are spent each year for research on nuclear energy, industrial robotics, heart diseases, and a cure for cancer. Meanwhile research on solar energy, AIDS, and sickle-cell anemia occupies a minor role in the quest for technological breakthroughs.

On this tack, the need for a technology policy becomes a little more acceptable in concept, if somewhat unclear in operation. However, in the absence of a conscious policy the paradox is clear—technical change occurs either because of an explicit government policy, or as a random by-product of thousands of autonomous decisions. Advocates of the current system will argue that is why the U.S. economy is so vibrant and responsive to new economic opportunities. Critics will say: "But of course; the lack of a conscious policy approach to technology is why we have disasters such as the Three-Mile Island nuclear accident, thalidomide, Love Canal, and Times Beach."

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Public Sector Role

It cannot be denied that government actions and funding play a decisive role in the nature and direction of technical change, and this is nowhere more obvious than in agriculture. It is clear that even in what we think of as our market driven economy, much technical change has come about because of non-market forces at work. The colleges of agriculture and the agricultural experiment stations exist because the public has agreed that the public sector ought to be a major player in the nature and direction of technical change in agriculture.

As I argue in *Economic Interests and Institutions*, our perception of the "market" offers a false notion of what constitutes a subsidy to one sector or another. The demise of the railroads as a dominant form of passenger travel in America had little to do with the "market" and everything to do with public subsidies to competing means of long-distance travel. In retrospect, the American automobile industry received an incalculable economic benefit from the construction, at taxpayer expense, of the interstate highway system—made more politically palatable by attaching the words "national defense" to the title of the legislation establishing the system. America's airlines receive massive public subsidies in locally financed airports and a federally funded air-traffic control system. Both auto and air travel have experienced profound technical change under these public-sector subsidies and regulations.

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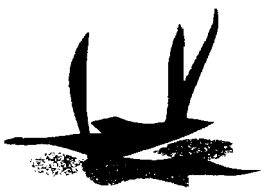
The question, therefore, is not whether the public sector has a role in the nature and direction of technical change. The question is, rather, *what shall that role be?* More specifically, should there be a conscious move towards a system whereby technical change is debated carefully by the public?

Technology Policy in a Market Economy

Problems with new technology arise because some inventions are not socially beneficial. Recognizing this fact we then must ask how to determine which inventions should be commercialized and eventually adopted widely. I suggest a two-stage system whereby: (1) inventions are encouraged in both the public and private sectors; and (2) careful mechanisms are then in place to determine which are acceptable for commercialization. The process could parallel that now in place for new drugs, where both the private and the public sector cooperate to encourage the search for new compounds, but the Food and Drug Administration (FDA) retains ultimate authority for approval before commercialization.

Of course such a system is not perfect. The question is not one of finding a perfect system, but rather finding a system that is better than any of the alternatives. When concerned with technical change outside of food and drugs, the current system—one *influenced but not monitored* by the public sector—has certain advantages and disadvantages. A system of increased control over technical change, however, would also have advantages and disadvantages. Under a policy of more conscious monitoring and control, new technology would be assessed for its impact on public safety and the environment. This approach would resemble the system now in place for drugs, certain foods, new herbicides and pesticides, and food additives. One possibility is a three-tiered system where some technologies are found to carry unacceptable risks, others scant risks, and some set aside for further study. The Office of Technology Assessment, an agency of the U. S. Congress, currently performs a valuable advisory role in appraising alternative technologies.



We *must* encourage the search for new knowledge and new techniques; who knows when someone will stumble upon a cure for cancer or AIDS? Likewise, how can we expect a breakthrough in one of nature's most binding constraints—cheap but "clean" energy—without the unfettered search for new techniques? But not all inventions are so compelling that they deserve a place in society; recent examples include DDT, aldicarb, PCBs, and Kepone.

Commercialization

Securing a favorable decision with respect to human and environmental risks should not alone be sufficient for commercialization approval. The new technology should then be subject to assessment of its socioeconomic implications. In agriculture, technical change is a contributing factor to farm consolidation. If it is decided that the loss of small farms is not in the public interest, then one could inquire about the probable costs of maintaining this particular agricultural structure. That is, one can begin to assess the likely costs of maintaining a particular agricultural structure should certain technological options which encourage farm consolidation be regarded as undesirable.

In blunt terms, would the citizens of this nation be willing to tax themselves an additional amount in order to maintain something resembling the current agricultural structure? If the answer is "no," then agriculture's socioeconomic conditions must be of little interest to the general public. On the other hand, if the answer to that question is a *qualified* "yes," then one can proceed to determine how much the public cares about this particular socioeconomic goal. The public's willingness to be taxed to accomplish this goal represents one possible starting point. As a general guide, one could expect the necessary tax to approximate the income losses that would accrue to producers through their inability to compete in national or international markets.

An alternative strategy would be to restrict certain technologies with no compensation to farmers and no tax on the public. Depending upon policies adopted by other nations, the competitiveness of domestic producers could be impaired for those commodities traded in world markets. For goods restricted to domestic markets, consumer prices will be higher than they would be with the new technology, and this difference can be considered a tax whose proceeds go to a less "efficient" agricultural sector. Some aspects of agricultural policy in Western Europe and Japan can be characterized in this way.

We must recognize that controlling technology for socioeconomic—as opposed to public health and environmental—reasons is difficult to rationalize in a market economy. But socioeconomic considerations have played a role in technology assessment for a very long time without attracting much attention. Current agricultural policy, in which massive income supplements accrue to certain fortunate farmers because production exceeds market demand, constitutes a non-trivial tax on all U.S. citizens. Indeed,

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between 1980 and 1988, direct cash payments to farmers totaled more than $75 billion. One way to regard this outlay is to see it as the necessary tax cost of maintaining political peace in agriculture because we do not have a technology policy.

Put somewhat differently, American agriculture is bounteous today because of technologies developed previously. In response to this bounty and its effects on prices the nation provides approximately $8-$9 billion annually in direct cash payments to selected farmers to offset the price and income effects of past technical change.

An alternative policy would have anticipated these payments as a *cost* of unrestricted technical change in agriculture, and, perhaps,

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chosen to forego the commercialization of the technology. To suggest controls on new technology is heresy to some individuals. But, economists have the professional obligation to ask inconvenient questions.

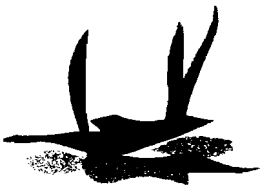
There is a clear collective interest in which new inventions are allowed to become part of normal economic life, regardless of the severe problems in knowing precisely how to operationalize this idea.

Unintended Effects

The *unintended* effects of technology are critical to our considerations. New technology appeals to the adopters because it reduces their *out-of-pocket* costs, or it permits new activities. However, there are other implications of technical change—some of which show up as actual cash costs to others. Commercialization and diffusion decisions are driven by predicted costs and benefits to those who produce and will use the technology, but not necessarily to those who may bear the brunt of the costs that the technologies generate.

These kinds of tradeoffs have been evident with labor-saving machinery. Such machinery has been viewed as a clear benefit to owners of firms, and a serious threat to those whose livelihood would be threatened by machines. Saving labor has a very different meaning depending upon whether one is a capitalist or a laborer. Something economically useful to me may be economically disastrous for others. Economists have a disciplinary tendency to dismiss such matters as mere pecuniary externalities and transfers undeserving of further analytical attention. But they are not dismissed by others.

It is naive to assume that all human creations are socially advantageous—nuclear bombs and opium (even rock music) come immediately to mind. It is equally naive to suppose that panels of "experts" can protect us against all manner of unforeseen social costs. And yet our technical capacity to create new life-forms through genetic engineering, to conjure chemical compounds which pose a serious threat to plant and animal life, and to harness nuclear power all suggest that the policy problem before us is how to balance probable benefits and costs of various technological futures. Wise technology policy requires a blend of opportunism, prudence, and deliberate evaluation of the possible outcomes. As the potential social costs of some technical changes have become more evident, it may be that the era of technological optimism— indeed boosterism—has happily passed into history.



Policy for Transitions

If the issue is perceived as one in which new technology is to be prohibited in order to protect the current economic interests of certain groups in society, then the idea of "technology policy" is unlikely to be very appealing. On the other hand, if the issue is perceived as one of easing the private and social costs of the transitions from one technological path to another, then the idea of a technology policy seems more consistent with traditional economic policy. Certainly all economically disruptive technological change cannot be prohibited. But, it is equally clear that the lifestyle and economic security of thousands of people and their families are too important to be dismissed as irrelevant in the face of some new technical opportunity—particularly when that new opportunity promises to boost the income of only a very few able to promote its adoption.

In the extreme, let us imagine a technical opportunity that would immediately result in a loss of jobs for, say, 85 percent of America's postal workers. Can we really imagine saying it is fine to turn individuals out into the streets to fend for themselves? Such a scenario would give new meaning to the notion of "labor-saving technical change." A better policy response to this situation would be to phase in the new technology, provide alternative

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means of support for those immediately displaced, and plan for a gradual diminution of that particular labor force. On this tack, the idea of technology policy is not so very radical after all. Similarly, in agriculture, family farm advocates who feel threatened by biotechnology would probably support a public strategy that would anticipate and recognize threats to traditional modes of production, and they, in response, would undertake research and public education programs to assist with problems of economic transition.

The controversy over technology in general, and bST in particular, could profit from this example. Critics of agricultural research observe that researchers have little interest in the socioeconomic implications of the technical change precipitated by their research. They also see an agricultural research establishment that seems to venerate technical change for its own sake and leaves the impacts of that change for others to worry about. With critics now acting on these perceptions, small wonder that agricultural research has become, in the last several years, extremely politicized.

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We could hunker down and denounce this nascent public interest in science as an unwarranted intrusion into the sacred halls of academe. I note, with interest, the article in the First Quarter 1991 issue of this magazine by McGuirk and Kaiser on the concerns of consumers for milk from bST-injected cows. They offer the obvious—but forgotten—observation that: "While it is important to provide consumers with the scientific evidence, consumers should not be expected to reach the same conclusions as scientists. It is well known that consumers consider factors neglected by scientists in forming their opinions about the safety of different products." One may choose to view these differing perceptions as a problem of consumers not being as "smart" as scientists—a conceit that can only contribute to the long-run detriment of science. But, because public funds support the vast majority of agricultural research, down that road lies ruin. The only other solution is to recognize a legitimate public interest in agricultural research and technical change. The agricultural research establishment could admit the collective interest in the nature and scope of its activities and take steps to incorporate those interests into its research agenda. Down this road, I suggest, lies the only prospect for a continuation of public support—and public funding—of agricultural research.

Turn to page 12 for Commissioner McGuire's response to Professor Bromley.

For More Information:

"Does the U.S. Need a Technology Policy?" *Economic Issues,* by Daniel W. Bromley, Department of Agricultural Economics, University of Wisconsin, Madison, Number 117, July 1990.

Economic Interests and Institutions: The Conceptual Foundations of Public Policy, by Daniel W. Bromley, Oxford: Basil Blackwell, 1989.

Biotechnology and Sustainable Agriculture: Policy Alternatives, edited by June Fessenden MacDonald, Ithaca, NY: Boyce Thompson Institute, 1989.