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Mack C. Shelley II

Iowa State University, mshelley@iastate.edu

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Abstract

John Portz and Peter Eisinger have provided a valuable conceptual overview of state government initiatives for economic development through biotechnology. Their three major models of policy choice - - based on interest-group processes, strategic planning, and competing interest groups in the allocation of planned development initiatives — seem to be sound theoretically and are convincingly examined empirically. Further, Portz and Eisinger provide a wealth of information regarding comparative state efforts at stimulating economic innovation, the differing state political dynamics underlying alternative development strategies, and differences in how such strategies have been implemented. Their analysis represents an important contribution to the current literature on comparative state economic development policy.

Disciplines

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THE STATES AND BIOTECHNOLOGY: INTERESTS, STRATEGIES, AND DIMENSIONS

Mack C. Shelley, II

*Political Science Department and Statistical Laboratory
Iowa State University
Ames, Iowa, 50011*

John Portz and Peter Eisinger have provided a valuable conceptual overview of state government initiatives for economic development through biotechnology. Their three major models of policy choice - - based on interest-group processes, strategic planning, and competing interest groups in the allocation of planned development initiatives — seem to be sound theoretically and are convincingly examined empirically. Further, Portz and Eisinger provide a wealth of information regarding comparative state efforts at stimulating economic innovation, the differing state political dynamics underlying alternative development strategies, and differences in how such strategies have been implemented. Their analysis represents an important contribution to the current literature on comparative state economic development policy.

I write from a somewhat differently focused perspective than that of Portz and Eisinger. My perspective on biotechnology and its role in economic development has been influenced by the key role played by my academic institution in large-scale state- and privately-funded research on molecular biology, specialized in plant and animal bio-

technology. That university also has been the home to a legislature-mandated interdisciplinary research effort in agricultural bioethics. This article turns to a brief summary of the recent activity in Iowa relevant to its reliance on biotechnology as an engine for economic development. This is justifiable on two grounds. First, Iowa is one of the states having a substantial political commitment to biotechnology research that was omitted from the Portz and Eisinger study. Second, the Iowa experience is sufficiently distinct to suggest a modification in the Portz-Eisinger taxonomy.

Briefly, the legislature of Iowa has earmarked over \$17 million in funds from state lottery revenues to support research on molecular biology for the express purpose of stimulating economic growth and diversifying the state's economic base. This effort was stimulated, as in other states, by perceived or real declines in traditional sources of economic strength as a consequence of international competition from the "global economy," demographic shifts and massive out-migration, and the replacement of established "smokestack" manufacturing industries with

service-oriented and high-technology businesses, among other causes. The state, and its political decision-makers, were particularly hard hit by the economic transformations of the 1980s. Preliminary 1990 census estimates, when compared against final 1980 census figures, suggest that there was a decline of perhaps 150,000 in the state's population during the 1980s. (When the state government began seriously to address the link between biotechnology and economic development, it was operating with the evidence of an estimated net loss of 80,000 people from its 1980 population base. The demographic shift occasioned by economic conditions and quality-of-life considerations (see Koven and Shelley, 1989) may have been much worse than the political actors had believed when they rather frantically searched in the mid-1980s for strategies with which to combat economic decay and population decline).

In addition to multimillion-dollar state "seed" funding for molecular biology, the state approved construction of a new \$30.5 million university facility to bring together within a single structure several academic laboratories and departments active in research on biotechnology. Further, a university research park, modelled after many others in the nation (such as those at Stanford, the University of Michigan, or Boston's Route 128) was initiated, with the expectation that firms which had become established through a university incubator system would "graduate" to the new facility. Some of the firms now located in the research park complex have been local leaders in biotechnology research, development, and marketing.

A series of recent publications (Shelley, Woodman, Reichel, and Lasley, 1988; Reichel, Lasley, Woodman, and Shelley, 1988; Shelley, Woodman, Reichel, and Kinney, 1990 (in press)) has examined various aspects of the economic and political nexus which links state government, corporations, and universities in cooperative research relationships. Our findings were based largely on surveys which tapped attitudes toward university-industry cooperation among biotechnology corporate research directors or chief executive officers, state legislators, university administrators, graduate students, farm operators, and university faculty involved directly or indirectly with biotechnology research and faculty outside that area. Additional work underway in this area of research includes a detailed examination of the structural effects on traditional academic research and teaching functions from the massive financing of new research agendas, and follow-up national surveys of biotechnology corporations.

It is not my purpose to summarize here that set of research findings. However, certain commonalities between our results and those noted by Portz and Eisinger

need to be emphasized, as do some topics that are not necessarily covered by these two streams of research. In light of the signal contribution by Portz and Eisinger to a theoretical understanding of the role played by state governments in economic development, this article will conclude with an attempt to incorporate additional information into their taxonomy.

A key word in the Portz-Eisinger analysis is "entrepreneurial." Universities and state governments long have been engaged in entrepreneurial activities, as part of an endless search for "outside" funding for research and economic activities. With biotechnology as an exemplar of this process, such efforts at entrepreneurship have become far more pronounced since the late 1970s. For state governments, the need to redress the disruptions produced by economic adjustment and regional economic decline during the 1980s resulted in a common tendency to try to "kick-start" faltering sectors of the economy by facilitating private investment in new areas of industry and services, and by providing financial inducements and start-up funds for cooperative research between academe and corporations.

For universities, the promise of enhanced funding for both traditional and completely new areas of research, including the hiring of new faculty, the development of new programs and departments, and the acquisition of new equipment and graduate assistants, was mingled with pressure from corporate donors and often from state decision makers and internal groups to provide an almost irresistible allure. This condition was in large part a consequence of reduced federal government support for research and for state-level programs generally. This reduction was in turn a concomitant of the world-wide retrenchment from aggressive positive central government activity aimed at fostering greater economic equality and full employment. A near-mania for privatization, the presumed innate superiority of capitalist management over government direction, and a *sauve-qui-peut* attitude on the part of politically-influential corporate leaders combined with constituent pressures demanding that the dislocations from the emerging world economy be redressed, to drive state government sponsorship of the promise of entrepreneurial effort.

One of the central research issues posed by Portz and Eisinger is how state policymakers make policy choices regarding which scientific endeavors to support, in the absence of scientific expertise of their own and given an imprecise set of contextual and political constraints. Among our survey groups was the membership of both chambers of the Iowa legislature, of whom about one-half responded to a mailed questionnaire addressing almost precisely

these concerns. Although the Iowa legislature is not identical to those of other states in decision making dynamics, the role of partisanship, relationships with the state executive branch, and the like, the response of these key political actors likely was conditioned by events and perceptions similar to those operating in most other states which have made a strong commitment of state funds and legitimacy to the economic development effort. What we found, then, is of fairly broad generalizability to state responses to stimulate economic development through support of biotechnology.

Among our clearest findings from our survey of state legislators was their uncertainty about whether this commitment would pay economic dividends. Overall, the attitudes of state legislators on many issues related to biotechnology did not differ sharply from the views held by members of academic respondent groups. However, a sharp distinction existed between the attitudes of the legislators and the views held by farm operators, a major constituency group of many of the responding legislators. The farm operators felt, or hoped, that biotechnology would, among other benefits, resolve farm surplus problems, provide scale-neutral benefits to farm operations of any size, and produce new profitable animal and plant varieties, whereas the state legislators had far less sanguine expectations of the revolution in molecular biology.

Portz and Eisinger address the complex topic of technology transfer, or the transition from research to successful commercialization. A missing item in their discussion, though, is the burgeoning links between universities and industries, which often take place with government support and encouragement. A particularly important aspect of the recent expansion of university-industry research relationships is the symbiosis implied by the growth of research parks, business incubator facilities, and specialized research centers, which often are located in university facilities. Research parks are a particularly concrete manifestation of the closer links that have been forged between corporate interests and the goals of academe.

In our own study of this phenomenon (Shelley, Woodman, Reichel, and Lasley, 1990), it is apparent that there are certain differences of opinion as to the goals of that particular form of university-industry research nexus. For example, biotechnology corporations are anxious to retain control over patent and marketing rights, whereas university and state legislative respondents tend to be more open to sharing both research effort and output. It is noteworthy in this regard that a recent series of national reports (e.g., *Academe*, 1990) has emphasized the difficulties encountered by some of the university-based research parks, and

has discussed the advantages and risks of university-industry research relationships.

Portz and Eisinger report briefly on a number of political and social issues revolving around state economic development efforts in biotechnology. While space constraints prevent a full discussion here of these matters, it is important to emphasize that further research in these areas is essential in order for a fuller social science perspective on biotechnology to develop. One such issue is that of the regulation of biotechnology, with attendant political implications such as anomic environmental activism, more organized Greens'-style political pressure both through demonstrations and at the ballot box, and mass public concern over the impacts of the experimental release of genetically-altered organisms.

Particular concern during the 1980s, and in fact at least since the Asilomar conference which imposed a temporary ban on genetic engineering work, has centered on the fear that potentially harmful genetically altered plant or animal organisms would escape from experimental studies and spread uncontrolled through the biosphere. Further public opinion research in this area of policy concern should be undertaken, perhaps along the lines of the national mass survey conducted by the Office of Technology Assessment. Additional work should be done on developing a systematic understanding of the responses of state government to meet such public concerns, particularly as manifested in state-level regulatory agencies and relevant controlling legislative statutes and executive orders. It would be particularly enlightening, as a case study in intergovernmental relations, to see to what extent the state regulatory efforts may mimic those of the federal government, such as the recombinant DNA advisory committee (RAC) at the National Institutes of Health or the umbrella Biological Sciences Coordinating Committee, as well as the adaptation of traditional mechanisms (such as the "generally recognized as safe" — GRAS — standards).

Other major political and social considerations have arisen in regard to biotechnology. Sustainable agriculture is of paramount concern to many of those who conduct research in agricultural biotechnology. Although difficult to define, sustainable agriculture clearly is linked to questions surrounding biotechnology. Will genetically-altered farm organisms, whether plant or animal, provide equal benefits for small-scale "family" farmers and for larger operations? Most research on the diffusion of technological innovations would suggest that the likely benefits would accrue disproportionately to larger-scale operations. Would biotechnology produce increased farm surpluses, thereby making more farm operators economically

marginal and driving down farm commodity prices? This is precisely the question that has come to the political forefront in states such as Wisconsin, in which the legislature recently enacted a ban on the use of genetically-engineered bovine growth hormone following strong political pressure from dairy farmers and from environmental interests that felt threatened by the new technology. More work on the interest group dynamics of the reaction to biotechnology must be done.

Animal rights provides another area of rising concern with potentially major political implications. Radical anti-animal experimentation groups have been active in Great Britain and other countries for some time, and their tactics are being adopted by some of the more aggressive animal rights groups in the United States. Problems such as those experienced by arthritic-kneed "geeps" (chimeric animals that are hybrids of goats and sheep) or the extremely cramped conditions under which animal production agriculture often takes place are amplified by the concerns of activist groups over the use of animals in laboratory experimentation (in biotechnology and otherwise) and in the commercial production of skins and furs. How state governments will address these potentially explosive problems remains to be studied.

Controversy over the human genome project, which promises to absorb a billion dollars of federal research funds in the effort to map the complex structures of the human genetic code, reveals yet another aspect to biotechnology. To the extent that key sectors of the mass public or of decision-making elites see potential advantages or threats to human health and welfare, and indeed to human evolution and to our survival as a species from the prospects of fundamentally altering the human genetic code, national and state government attention inevitably will be turned to the implications of this research. Here, there is strong potential that religious sentiments, as well as other moral philosophies of what it means to be human and how people ought to be defined and treated, are likely to enter into the political fray in major ways. Whether state governments will be able to address such matters successfully remains to be seen. The gingerly way in which many state governments have approached the abortion issue suggests perhaps that human genome research will produce equivocation from decision makers for as long as public opinion makes that reaction possible, to be followed by intensive lobbying by activist groups on either side of the controversy and partial solutions to the attendant legal, political, social, and economic issues which will accompany such a fundamental approach to human nature and human welfare.

Portz and Eisinger have provided a real service to the study of the political dimensions of biotechnology. Perhaps the real test of their models, and therefore of their theoretical conceptualization, lies in the ability of their taxonomy to incorporate new information. My reading of the Iowa situation regarding biotechnology and economic development is that that state's experience would fit best with Portz and Eisinger's hybrid model. However, the Iowa experience does not fit very comfortably into that framework, both because the planning exercise was strategic only in name, and because interest-group activity was limited to only a few actors. This consideration leads to the following proposal for a reconsideration of the Portz and Eisinger typology. Such a typology would, for one thing, have to address the redistributive, as well as the distributive and regulatory dimensions (to borrow from Lowi) of state actions to foster economic development, many of which may be simply another form of "trickle-down" economics which provides lots of money for businesses and entrepreneurs but which produces little payoff in jobs for new workers or for the less privileged segments of the established work force. The Iowa experience in particular has been characterized by widespread concern over the scale-neutrality of biotechnology, a concern that was deepened by the decline of family-scale farm operations during the 1980s and a perceived growth of agribusiness-run farms.

Also, the role and the extent of interest aggregation in the political deliberations that take place regarding biotechnology-driven interventions in the state's economy needs to be clarified. Whether this is an open process, with fairly well-thought out planning of the consequences of this development focus, will determine which actors, including the mass public, benefit from the decisions that are made. This consideration, for example, is related to implications for university teaching and research, worker health and safety, environmental protection, differential benefits for various sectors of the state economy, whether targets for new jobs creation are met, and the allocation of symbolic, as opposed to material, benefits. In other words, the emphasis perhaps should be more on differential policy outputs and less on the different processes by which states have made biotechnology a major focus of their economic development efforts.

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