News and Comment

Ohio: Old Laissez-Faire Attitude on Linking Education, Research, and Industry Undergoing Change

A new war between the states is raging. It is bloodless, but not without bitterness; hard fought, but without clear criteria to judge who is winning. The battle is for new industry and, more particularly, for science-oriented new industry.

This opening paragraph in the introduction to a report called "The Scientific Complex—Challenge to Colorado" conveys both the militant tone and the emphasis put on science-based industry by the new apostles of economic growth active in almost every state in the union.

The Colorado report, prepared by the Denver Research Institute of the University of Denver for the Public Service Company of Colorado, does a good, straightforward job of defining what is meant these days by "a 'scientific complex' also known as a 'university-industry complex', 'research-based complex' or 'the type of thing they have around Boston'."

Common to all these complexes, according to the report, are three main elements. (i) Science-based industry composed of industrial research and development laboratories, technically oriented manufacturing plants employing a large percentage of scientists and engineers and supporting suppliers and services. (ii) One or more major universities in which basic and applied research and graduate study in science and engineering are carried on as well as graduate study in management and administration. (iii) Federal research facilities operated directly by the government or under contract by universities or industry.

Put these all together and you have summarized the situation at the two most conspicuous university-industry complexes, around Cambridge (M.I.T.–Harvard) and San Francisco (Stanford–Berkeley), and also lesser developments in, for example, Ann Arbor, Michigan, and the so-called Research Triangle in North Carolina.

The specialty of these major complexes has been frontier technology, primarily in electronics, and the major market for their wares existed during the past decade almost entirely because of the vast military air defense and missile programs and the space program. The jack in these beanstalks, therefore, has been primarily federal.

As competition among the states for new industry has grown sharper, economic developers have turned to the university, research institute, industry complex as a new gambit to add to the older and less sophisticated lures of free factories, subsidized utilities, tax breaks, and copious and unorganized labor. The extraordinary power that the idea of electronics research and manufacture in particular has over the minds of the developers was exemplified by the waves of delegations which came to Washington to plead the case of their localities as sites for a big NASA electronics research center, which, as the odds clearly indicated, will be located in Boston.

One state which, at least until recently, had shown mild organized interest in competing on the technological new frontier was Ohio. Ohio's attitude is, on the surface, anomalous since the state ranks in the top four states in manufacturing, was a pioneer in applying science and technology to the manufacture of consumer goods, and was a leader during World War II in turning out weapons and materiel.

After the Korean War, however, Ohio and other Midwestern states lost ground to East and West Coast states in the competition for defense contracts, and this loss became an issue in the Midwest during the 1960–61 recession when the Defense Department released a report which showed that the distribution pattern of military prime contracts was changing at the particular expense of the Great Lakes states.

The report had made the point that production contracts in general follow research and development contracts, and Ohio, while leading other states in its region, was outdistanced by several East Coast states and left virtually at the starting gate by California. A later report showed that Ohio in 1962 won prime contracts for experimental, developmental, test, and research (EDTR) work worth $133 million, while the figure for California was nearly $2.4 billion; for New York, $664 million; and for Massachusetts, $361 million. New Jersey, Pennsylvania, and Washington state all won more than $200 million in EDTR contracts, and even little Maryland had $190 million.

The realization that federal tax dollars created jobs and prime industrial capacity in other states and that Midwestern scientists and engineers, educated largely in publicly supported institutions, were decamping for the coasts in significant numbers was a bitter pill for the Midwest states to swallow. The possibility of taking concerted political action has appealed to some Midwest officeholders and was still being talked about by Ohio governor James A. Rhodes at the Governors' Conference in Cleveland in June, where he told a meeting of Midwest Republican governors, "The squeaking wheel gets the grease. Let's get our senators and congressmen to refuse to vote for appropriations unless the Midwest gets its share."

Efforts toward the development of scientific complexes in Ohio are seriously under way, particularly in Columbus, the site of Ohio State University, and a delegation from Columbus journeyed to Washington to put in a bid for the NASA electronics research center.

But a visitor to Ohio this summer would find only scattered evidence of acute anxiety that Ohio will be left out when the scientific revolution triumphs. And right now Ohio is doing all right.

Ohioans say that, in a year when automobile sales are good, Ohio with its steel, metal products, and rubber industries is guaranteed good times. And this is an excellent year for auto sales. But Ohio's strength as an industrial state appears to have been established well before the mass production era for autos began.

Ohio was the first Midwestern state to be settled and a leader in industrialization. With Lake Erie on the north and

the Ohio River forming its southern border, the state is well served by low-cost water transportation. Ohio's predominantly flat terrain made it easier to build canals in the early days, and then a network of railroads and highways linking Ohio's towns and cities.

In addition, Ohio was endowed with wood, coal, oil, natural gas, clay with industrial uses, and other nonmetallic minerals in quantities sufficient to make it 16th among the states today in value of mineral production. And despite industrialization, Ohio continues to rank as one of the leading agricultural states and farming remains a stable element in the state's economy.

Heavy industry and manufacturing dominate the Ohio economy. Leading industries, in terms of value added by manufacture, are transportation equipment, primary metals, electrical and nonelectrical machinery, fabricated metal products, and food products.

None of these industries are notable for extravagant support of basic or applied research, and it is fair to say that top management in these industries is considerably less research-oriented than management in, for example, the electronics or aircraft industries.

Ohio's early and successful start, some suggest, led to a conservatism in business and finance, social structure, and political and cultural views. Ohio has, after all, produced such presidents as McKinley and Harding; Senator Robert A. Taft; and treasury secretary George M. Humphrey—all identified in one way or another with conservatism, and, in Harding's case, "normalcy."

Conservatism, if that is the word for it, does not seem, however, to have led to complacency in Ohio's established industries, which appear to be aggressively competitive and flourishing. But expansion into the space and nuclear fields has not been strongly encouraged. One executive of a thriving young frontier technology company, for example, said that he and his associates had to go to Chicago for "risk-taking capital."

Ohioans, up to now, do not seem to have adopted the view that investment in education brings a high ultimate economic payoff to the degree to which, for example, Californians have. A National Education Association study comparing school operating costs in relation to population and income of the states shows that while Ohio stood 14th in per capita personal income in 1962, it ranked 25th in average yearly operating expenditures per pupil in the following school year. It ranked 18th in terms of average salary of school instructional staffs in 1963–64, but 29th in school costs per adult.

In higher education, Ohio is going through a period of reappraisal and reorganization (*Science*, 17 July), and support has been growing behind the doctrine that the economic future can be brightened by freer use of public funds to educate scientists, engineers, and other professionals, and to support research.

Science and engineering education in Ohio in the past has been dominated by three schools—Case Institute of Technology in Cleveland, which is private; Ohio State University in Columbus; and the University of Cincinnati, a municipal university.

According to one close observer, Case is becoming "more science oriented." O.S.U. continues to offer the broadest program in science and engineering, and Cincinnati, where the engineering school was a pioneer in the cooperative program which ties the school close to industry, is staying with a policy that stresses preparation of engineering graduates to serve the "civilian, consumer economy."

Cleveland, according to a Case administrator, is "a heavy industry town and not a research-minded town." Consulting work for faculty with local industry—one of the signs of university-industry interaction—is not nearly so extensive in Cleveland as in the Boston, San Francisco, or Los Angeles areas. While Case maintains close ties with management and the research arms of management in Ohio, especially through alumni, the research atmosphere seems to have given Case greater incentive to "go national."

In Cincinnati, a major machine tool center, there is much local-owned industry and a long-standing emphasis on a "proprietary interest" in research. Research, in other words, is expected to return direct and immediate benefits, and there has been little enthusiasm in industry for support of basic research. There are signs, however, that management is "turning the corner" as far as its attitude toward research goes. And plans are now afoot for a new $12-million university facility for research in chemistry, chemical engineering, metallurgy, and materials, which should provide a base for broadening the university-industry research efforts in southwest Ohio. Half of the money for the new labs will come from the state as the University of Cincinnati is absorbed into the state university system.

Expansion of scientific and technical programs in existing state universities will be emphasized in the spending of some $175 million earmarked for higher education in a recent bond issue.

Ohio University at Athens is building a $4.5-million research center for science and engineering as a start on a larger research complex. The University already offers Ph.D. as well as master's programs in chemistry and physics and also in a number of nonscientific fields. (It was reported incorrectly in the 17 July story that doctoral programs in some state universities other than Ohio State were cooperative programs with O.S.U.)

Ohio University established its independent doctoral degree program in 1956. The program was accredited by the North Central Association of Colleges in 1961 and is attracting a rapidly increasing number of graduate students. A dozen Ph.D.'s in the physical sciences have been granted so far—seven in chemistry and five in physics—and the chemistry and physics departments now each have 41 graduate students. About half the students in each department are expected to go on to earn their doctorates.

The university expects to grant its first doctorates in psychology soon, and serious consideration is being given in the engineering school to the creation of a doctoral program in electrical engineering.

The major producer of scientific and engineering manpower in Ohio is Ohio State University, as has been the case over the years. O.S.U. certainly ranks among the top ten American universities in the total number of Ph.D.'s turned out, and O.S.U.'s engineering school was an early pacesetter in engineering education.

Critical observers of Ohio State say that in science and technology the university has always been expected to serve the needs of Ohio industry. They suggest that Ohio industry until recently has not exerted great efforts to keep up with the latest technology, and that, therefore, while O.S.U. continues to be strong in preparing well-trained graduates in such fields as industrial engineering, ceramics, and metallurgy, there has been less emphasis on specialties where the research frontiers have moved more rapidly.

In the sciences, it was not until the late 1950's that Ohio State began to expand its federally supported research programs at a rate comparable to that in most other Big Ten universities. Research projects administered by the university research foundation rose in total value from about $4 million a year in 1957 to over $10 million in 1963.

Various explanations are put forward for the lag, ranging from an indigenous reluctance to accept federal funds to a simple lack of lab space caused by a lapse in new construction during the Depression years and an unwillingness on the part of the legislature, after the war, to put money into research facilities and researchers' salaries while demands were so heavy for new housing and classrooms for undergraduates and salaries for teachers. It might be noted that an antenna research center was located at Ohio State during World War II. Antenna research had rather limited postwar implications for the institution, while at other universities, notably M.I.T., Caltech, and Chicago, wartime work gave great momentum to later research.

Observers say that a significant change at Ohio State came in the early 1950's when a successful drive was mounted to expand and modernize teaching, clinical, and research facilities at the medical school and medical center on the Columbus campus. The success of this movement is seen as providing a model for later action in behalf of graduate education and research in the university at large.

As has been noted, much of the money in the new state bond issue will go to strengthen scientific and technical education around the state. And while state legislators may grumble, for example, about some professors' getting higher salaries than the governor, the atmosphere has altered, as is indicated by the legislature's appropriating $144,000 in the last session specifically for the hiring of six "Nobel level" professors.

There is some irony in the fact that Ohio seems to be embracing the scientific-complex doctrine at a time when there are signs of a slackening in the defense spending which has largely financed the formation of the scientific complexes. An estimated $1.8 billion will be cut this year from funds for military procurement and research and development. And Defense Department officials have been saying in recent weeks that cuts of about $1 billion a year from the $50 billion a year defense budget are contemplated for the next 5 years. The paring of the budget can be attributed to completion of the planned buildup in both the nation's nuclear arsenal and its conventional warfare capacity, plus Defense Secretary McNamara's economy drive. Neither government officials nor industry forecasters feel that either the civilian space program or the military space program will expand enough in the years immediately ahead to take up the slack produced by the defense budget cuts.

Any significant deterioration in the international situation, or a Goldwater win in November which resulted in major changes in defense or space policy, could, of course, change the prognosis.

The bottom is obviously not going to drop out of the defense business, but the expansion of the past decade, particularly in the high technology sectors of the defense and space industries, appears, as the jargon has it, to have topped out. And this competitive field will doubtless grow more competitive.

Ohio is in a position different from that of California, where remarkable growth has been fostered by the boom in the airframe, missile, and electronics industries fueled with federal funds. Ohio is a major industrial state which has profited in the past and still profits from military contracts but which has a more highly diversified and a much more consumer-oriented industry.

This is not to say that Ohio now necessarily has the laugh on the states where defense business plays a bigger role. Ohio's economic fate is tied more directly to the general economy, and the state has been more vulnerable to the ups and downs of recession and recovery. Several counties in the southeastern part of the state are in poor enough shape economically to be included in the distressed area of Appalachia. And the full consequences of automation have not yet been felt in Ohio's factory towns.

But Ohio has the useful experience and habit of selling to many customers, not just one. The state seems to be adopting a new attitude about educating and using scientists, engineers, and technicians. And with its natural advantages of location and resources, Ohio should be able to trim its sails to meet the new economic weather that seems to be brewing.—JOHN WALSH

Barry Goldwater on Space: GOP Candidate Wants Military, Not Civilians, To Run Space Program

Question: Senator, how do you feel about the program of sending a man to the moon?

Senator Goldwater: Well, if I could pick the man, I would be all for it.

This exchange, during one of Senator Goldwater's whistle-stop appearances in the New Hampshire primary last February, may typify the level of humor to be anticipated in the coming campaign but it considerably underestimates what the impact of Goldwater's election on the space program might be. Far from merely replacing Grissom and Young with Nelson Rockefeller and LBJ in the Gemini capsule, Goldwater would make some fundamental changes in the nature and direction of space and defense policy.

Since Goldwater advocates turning all manned space research over to the military, it is not surprising that his views on this subject find more favor with the Air Force than with the civilian space agency. While there is a good deal of sympathy for Goldwater's views within the Republican Party, it is not reflected in this year's campaign strategy. The platform adopted in San Francisco earlier this month criticizes the Democrats for undertaking a "needlessly expensive crash program" and pledges the Republicans to the difficult if not contradictory goals of "replanning . . . the present . . . program to provide for a more orderly, yet aggressively pursued, step by step development." But the Senator's convictions extend far beyond the platform ambiguities accepted by his colleagues. He agrees with Republicans that the moon program ought to be slowed down, but he has in mind a definition of the term *replanning* considerably broader than that implied in the platform.

Taking as his motto the prophecy of Werner von Braun, the German rocket specialist who has been working for the U.S. since the close of World War II—"I am convinced that it is man's destiny to enter space and that he who controls the open space around us is in a position to control the earth"—Goldwater has repeatedly called for a space program directed by the military for military purposes. Repetition in political speeches may signal a paucity of interests as well as an intensity of conviction, and it is rarely wise to take politicians literally. Nonetheless, Gold-