Technology and the Oil Nations: Quick Leap to Modernization Unlikely

To hear some observers tell it, the oil producing nations of the Middle East, prospering from a large infusion of "petrodollars" gained from the sale of high-priced oil to an energy-greedy world, are on the verge of a major leap toward industrialization. With their vast new capital resources, the theory goes, such nations as Iran and Saudi Arabia will be able to launch new industries, make the deserts bloom, educate their populations, and generally drag themselves up from Middle Ages backwardness to the atomic era lickety-split.

That may eventually come to pass, but a parade of witnesses who testified recently at House hearings on "Technology Transfer to the Organization of Petroleum Exporting Countries" suggested that the path to modernization will be long and difficult. The hearings, held by the House subcommittee on domestic and international scientific planning and analysis, focused primarily on Iran and Saudi Arabia, the most significant of the OPEC nations and the only two that have intergovernmental bilateral agreements with the United States aimed at scientific-technical development.

Repeatedly the question was raised by congressmen as to whether it might not be "risky" for the United States to give these newly rich nations much technical assistance. Might we not be creating a new Japan—a nation or nations that might compete with us so vigorously in world markets as to erode our trade position?

And repeatedly the answer came back from the witnesses: there is little to fear and much to gain. Oswald Ganley, acting deputy assistant secretary of state in charge of international scientific affairs, found it unlikely that the oil nations would become significant competitors for American industry in the near future or even in the mid-term. "I think these countries have a long way to go before they become serious competition," he said.

Similarly, Robert E. Hughes, the National Science Foundation's assistant director for national and international programs, said the technology base in the OPEC countries is "so weak that it will take many years of development, especially in the field of science education, for them to develop a technology which would be seriously competitive with the modern industrial states."

Most witnesses agreed that Iran currently has a greater capacity to absorb industrialization and new technologies than does Saudi Arabia. But even in Iran, the prospects may have been oversold. As Quentin M. West, administrator of the Agriculture Department's Economic Research Service put it: "You know, the Shah was going to put Iran into the 20th century. He was going to exceed France's industrial capacity by 1980. And so they have gone all out there. I think they have developed some good planning. But I think they did get more enthusiastic then even the hugh resources which they have would allow."

Administrative Snags

Lack of management skills and of an effective administrative framework was cited as a major problem in both countries. West noted that there have been repeated snags in efforts to beef up the dairy industry in Iran. Even though American suppliers are eager to sell dairy cattle, and the Iranian private sector is eager to get them, the transfer has lagged because the government, which has agreed to subsidize the transportation costs, has been slow in paying the shipping bills. This is apparently because high-level Iranian decision-makers "forget they have to communicate with the people below," West said, ". . . so there is someone down here who is supposed to implement something like paying for transportation, and he may not have gotten the word."

In Saudi Arabia, the existing infrastructure to support technological advance and industrialization is weak, according to a survey made by a team of NSF officials in May. The survey team found that Saudi Arabia's level of scientific and technical activity is "relatively undeveloped, although rapidly improving." In little more than a decade, three universities have been established, industrial work has begun in several highly technical areas, and training programs and research institutions have been launched. All this constitutes "a significant start," the NSF group concluded.

But there are major gaps. Graduate programs are "just beginning . . . and will probably develop slowly," with the result that the kingdom will continue to depend on advanced training facilities in the United States and other countries. Research in the universities is at "a very low level," with few faculty members having the time or qualifications to pursue research. There is "a chronic shortage of technicians," and the levels of trained scientific and technical manpower "are still quite low." Research institutions outside the university are "largely undeveloped," although there are ambitious plans for several research laboratories. The Saudis clearly have the ability to build well-equipped laboratories, such as a new central laboratory for agricultural research that has been completed but not yet staffed. However, trained manpower is expected to be the major limit to improving Saudi science and technology, the NSF team concluded. Thus "the use of foreign nationals in large numbers will be necessary."

No similar survey of the scientific infrastructure of Iran has been made by American specialists.

The witnesses were generally enthusiastic about the benefits to be gained from fostering technology transfer to the oil nations. Such cooperation was viewed as a way to promote stability and prosperity in the Middle East, tie the major oil producers more closely to the United States both economically and politically, and recoup some of the dollars that have been hemorrhaging toward the Middle East in payment for oil. The oil nations are in the curious position of being developing countries that have the ability to pay for any technical assistance rendered to them by the industrialized nations. But as staff members of the House committee pointed out, the volume of technology transfer thus far appears too small to make a significant impact on balance of trade or balance of payments problems.

Just how much technology transfer, in the form of hard goods, know-how, or trained personnel, is already under way was not made clear at the hearings, partly because such transfer mainly occurs in the private sector and the government agencies lack firm data on what is happening. But the gist of the testimony, as summarized by subcommittee chairman Ray Thornton, was that "the main transfer that has occurred to date has been a transfer of institutions, the creation of commissions and an attempt to formulate problems and programs . . . to put in place institutions which are capable of handling the transfer of technology."

Both of the major oil producers have made it clear at meetings of the bilateral commissions with the United States that

they are interested in a variety of scientific and technical help. Iran, for example, is seeking help in agriculture, fertilizer production, manpower training, housing, urban development, remote sensing, seismic studies, geological and mineral surveys, oceanography, and even radioastronomy. Why radioastronomy? One theory is that the Iranians figure if they become a world leader in some such esoteric field, it will be easier to interest talented Iranians who are now working abroad in returning home.

The Saudis have expressed great interest in desalination, solar energy, irrigation techniques, modular housing, educational technology, and hydrocarbon technology, among other fields. Both countries are interested in nuclear technology, the Iranians more immediately, the Saudis possibly in conjunction with a large-scale desalination plant. And both are pursuing various industrial technologies with the private sector and in a number of different countries.

One widely touted possibility—that American know-how and Middle East oil money might unite to develop the Third World—has not yet blossomed. As Lewis Bowden, the Treasury Department's deputy for Saudi affairs, put it: "There has been a good deal of talk without much substance of what people are calling triangular investment. What they have in mind here is that Saudi Arabia or Kuwait or Iran, a capital surplus country at the present time, would put capital into another developing country—Egypt is usually mentioned in this respect. The third part of the triangle would be managerial know-how from a developed country like the United States or Germany or France. So far as I know, except in the private sector, there have been no such combinations and we do not really know what the future will hold in that respect."—PHILIP M. BOFFEY

Recombinant DNA: NIH Group Stirs Storm by Drafting Laxer Rules

A flurry of objections has been touched off in the biological research community by a National Institutes of Health committee's first attempt to draft the terms under which work may proceed on a potentially revolutionary but currently embargoed technique of genetic manipulation. Some think the proposed rules will impede research by their unnecessary strictness, but the majority of objections, including a petition signed by 50 biologists, hold that the NIH committee has set safety standards considerably laxer than those agreed upon by the international conference held at Asilomar to discuss how the new technique should be controlled (*Science*, 14 March 1975).

The technique, in brief, involves the use of recently discovered enzymes to rearrange the genetic material of living organisms in novel combinations which may never before have occurred in nature. The reason for the embargo is that the recombinant DNA molecules, as they are called, might escape from the laboratory with consequences which cannot be foretold but which, at the worst imagining, include the generation of novel and uncontrollable epidemics.

The technique will doubtless procure several Nobel prizes for those skilled and lucky enough to bring home first fruits, not to say many practical benefits in medicine, industry, and agriculture. There is considerable impatience in many laboratories for the NIH to complete its guidelines so that work can begin. The NIH committee* is working in a charged atmosphere in which suspicion is rampant and in which everyone has heard rumors that embargoed experiments have been clandestinely performed at certain laboratories. (*Science* could confirm none of these rumors; Paul Berg of Stanford University, the guiding spirit of the Asilomar conference, says he has seen no published experiment which contravenes the principles adopted there.)

The root cause of the objections attracted by the committee's first draft should probably be sought not in any lack of goodwill on the part of the committee—although some charges of conflict of interest are being voiced—but rather in the extraordinary difficulty of translating the general principles laid down at Asilomar into practical guidelines that everyone can live with.

Because of the way it has reacted to the criticism, however, the NIH committee has woven itself into a procedural tangle which may not be resolved without some internal friction. Essentially what has happened is that a subcommittee under David S. Hogness of Stanford University drafted a set of guidelines which were substantially weakened during a July meeting at Woods Hole attended by 8 of the committee's 12 members. The weakened, Woods Hole version attracted serious criticism on that account from Berg and from the signatories of a petition organized by Richard Goldstein of the Harvard Medical School and Harrison Echols of the University of California at Berkeley.

In response to the criticisms, committee chairman Dewitt Stetten, NIH Deputy Director for Science, asked Elizabeth Kutter of Evergreen State College in Olympia, Washington, to form a new subcommittee and propose alternative guidelines. The Kutter guidelines are due to be completed and sent to committee members this week, and will probably be more stringent than either the original Hogness guidelines or the Woods Hole version. According to committee secretary William J. Gartland, even the Hogness version does not adequately reflect the tone of caution implicit in the Asilomar conference's recommendations. The committee will discuss the Kutter guidelines at its meeting in San Diego early next month, but discussion may be complicated because of the irritation felt by some members at the way the Woods Hole version has apparently been abandoned.

What the Woods Hole guidelines essentially do is to set up categories of physical and biological containment and assign combinations of the two to the various types of recombinant DNA experiments at present envisaged. There are four levels of physical containment, named P1 to P4 in ascending order of strictness, and three levels of biological containment, designated EK1 to EK3 because it is assumed that most experiments will take place in the common laboratory strain K12 of the human gut bacterium *Escherichia coli*.

*Members of the committee, known as the Recombinant DNA Molecule Program Advisory Committee, are as follows: DeWitt Stetten, NIH (chairman); Edward A. Adelberg, Yale; Ernest H. Y. Chu, University of Michigan; Roy Curtiss, University of Alabama; James E. Darnell, Rockefeller University; Stanley Falkow, University of Washington, Seattle; Donald R. Helinski, University of California, San Diego; David S. Hogness, Stanford University; John W. Littlefield, Johns Hopkins Hospital; Wallace P. Rowe, NIH; Jane K. Setlow, Brookhaven National Laboratory; Waclaw Szybalski, University of Wisconsin; Charles A. Thomas, Harvard Medical School; Elizabeth M. Kutter, Evergreen State College; John Spizizen, Scripps.