Why We Need A Tough National Science Adviser

By Jerome B. Wiesner

FEW INSTITUTIONS of the Federal Government have had as rapid a rise to prominence and lapse into oblivion as the President's Science Advisory Committee (PSAC). Few institutions have been punished as thoroughly for doing a good job. And few institutions are needed more right now.

A flood of recent events and problems are directly traceable to the absence of a presidential advisory group: The Challenger disaster, the unproven and exaggerated claims about military inferiority and need for excessive amounts of new military technology and hardware, the exaggerated claims of Soviet cheating on arms agreements, the disregard by the responsible agencies of serious environmental and public-health problems and the loss of competitiveness of much of American industry.

Jerome Wiesner, science adviser to Presidents Kennedy and Johnson, is president emeritus of Massachusetts Institute of Technology.

It may be sheer coincidence but the disintegration of the U.S. space program, sliding from a position of world leadership to one of embarrassment, has paralleled the decline of presidential science advising. Last year American space scientists had to send their instruments on Soviet space probes to investigate Halley's Comet, and American companies wanting to launch communication satellites are looking to European companies for launchings.

Meanwhile, much of U.S. industry, both low and high tech, has gradually slipped out of competitive range of industries in other nations, most notably in price, but often in quality as well. And this turn of events has occurred despite U.S. research activities remaining among the world's best.

The demise of the President's Science Advisory Committee parallels a growing U.S. tendency to disregard inconvenient facts in arriving at decisions. This tendency is particularly strong on matters of defense. The fear of Soviet military might has long provided an excuse for exaggerating the threat in order to justify many unnecessary

See SCIENCE, D4, Col. 1

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THE WALL STREET JOURNAL THURSDAY, AUGUST 21, 1986

Military R&D Depletes Economic Might

By Frank R. Lichtenberg

The countries that lost World War II have been winning the battle for world markets in recent years. They have gained from not directing enormous amounts of capital to military uses.

Japan and West Germany are both experiencing substantial trade surpluses, in 1983 exporting 17% and 10% more, respectively, than they were importing. The U.S., the U.K. and France, which emerged victorious from the war, are now experiencing large trade deficits. In 1983 the U.K. and France exported about 10% less than they imported, while for the U.S. the deficit was an enormous 26%.

Differences among the industrialized nations with respect to trade performance probably are attributable to a variety of factors, but a potentially important, and perhaps not widely appreciated, factor is the difference in rates of investment in research and development.

Finding the True Share

An important determinant of the competitiveness of a country's products in international markets is the amount of R&D invested to develop and produce them. "Process" R&D enhances competitiveness by reducing cost, while "product" R&D does so by improving product quality and reliability. Now, the U.S. devotes almost exactly the same share—about 2.6%—of its gross national product to R&D investment as do Japan and Germany. (The U.K. and France have a somewhat lower R&D investment share, about 2.2%.) But a substantial fraction of the R&D investment of the U.S., the U.K. and France is military in orientation. According to official estimates, about 27% of U.S. and U.K. R&D investment, and 21% of French R&D investment, is military.

These estimates are based on the assumption that the government sponsors military R&D, which for the U.S., at least, is clearly false. Defense contractors devote a substantial fraction of their own R&D personnel and facilities to the preparation of technical proposals that are the basis on which the Pentagon awards competitive contracts for major weapons systems. The true share of (government plus private) military R&D in total U.S. R&D investment is probably about 35% to 40%. In contrast, less than 4% of Germany's, and 1% of Japan's, R&D investment is military. These low shares reflect the deliberate policy on the part of the victors of World War II that the reconstructed Japanese and German economies would exclude defense sectors. Military research and production would be the province of the wartime Allies.

Fewer than 1% of 8,000 patents produced by Navy-sponsored research and available for licensing are licensed; almost 13% of the Agriculture Department's patents are.

Military R&D no doubt enhances the competitiveness of U.S. military products: The U.S. (as well as the U.K. and France) is a net exporter of arms. But armaments represent a relatively small share of U.S. exports; perhaps 35% of its R&D investment is dedicated to products that account for only 5% of our exports.

Military R&D also may enhance, to some extent, the competitiveness of U.S. civilian products. The dominance of American producers in the world market for civilian aircraft, for example, is probably attributable in part to the technological advantage conferred on them by having performed government-sponsored research in military aviation. There is a question, though, of how extensive the civilian benefits, or "spinoffs," from military R&D generally are. Most of the military R&D budget is devoted to the advanced development of prototypes rather than to basic or even applied research, which are more likely to generate spinoffs. The atmosphere of secrecy in which much military R&D is conducted also tends to inhibit spinoffs.

Two pieces of evidence suggest that in most cases, few civilian benefits result from military R&D. First, companies performing defense R&D under contract for the government decline to exercise their right to claim title to about two-thirds of the innovations they produce. Second, fewer than 1% of the more than 8,000 patents produced by Navy-sponsored research and available for licensing are licensed; in contrast, almost 13% of the Agriculture Department's patents are licensed. These data are suggestive rather than conclusive; no one really knows how extensive the civilian spinoffs from military R&D generally are. But it is safe to say that a dollar spent on defense R&D does much less to enhance our international competitiveness than does a dollar spent on civilian R&D.

Because a country's total (civilian plus military) R&D investment, or its ratio to GNP, is not in any meaningful sense fixed, an increase in military R&D need not imply an equivalent reduction in civilian R&D. (The strong negative correlation across the five countries between military and civilian R&D expenditure—both divided by GNP—is, however, striking.) But increases in military R&D expenditure, particularly rapid increases such as those occurring in the U.S. earlier in this decade, tend, at least in the short run, to drive up the prices of scarce resources (such as scientists and engineers) required to perform both types of research. Starting salaries of engineers and technicians were increasing at an average annual rate of about 10% during the recent defense buildup; the rate of increase fell to about 3% after Congress and the administration agreed to end the buildup. The escalation in research costs presumably reduced real growth of civilian (if not of military) R&D investment.

Policy Implications

So we can posit that one factor contributing to the superior trade performance of Japan and Germany, relative to that of the U.S., the U.K. and France, is the former countries' significantly higher rate of civilian R&D investment relative to their GNPs. It is true that that these countries' relative rates of total (and civilian) R&D investment have remained fairly stable over time, whereas only recently have the trade performances of the U.S., the U.K. and France compared so unfavorably with those of the other two countries. But Japan and Germany began the postwar era at a substantial technological disadvantage. By maintaining a higher postwar rate of investment in civilian R&D than the countries that defeated them, they were able to reduce the gap and eventually to achieve technological parity or even superiority.

The policy implications of this analysis are clear. Advocates of large U.S. military R&D outlays argue that they are necessary to compete effectively with the Soviets. But how the U.S. fares in competition with the Soviet Union depends upon the relative economic strength of the two nations, as well as on their relative military strength. A high rate of military R&D spending perhaps contributes to our military strength, but it weakens our economy by reducing civilian R&D investment and thus our ability to compete in global markets.

Mr. Lichtenberg, an associate professor at the Columbia University Graduate School of Business, is affiliated with the National Bureau of Economic Research.

A Tough Science Adviser

SCIENCE, From D1

technical developments and military purchases. The same fear has been used to hide the damage being done to the U.S. science and technological enterprise by the Pentagon's control of employment for many technically trained persons and funding for much advanced research.

But 40 years of priorities tilted heavily towards the military, even taking into account the positive achievements, have brought U.S. civilian technology to its present position and ironically, have had the net effect of continuously increasing our real national danger.

Because of the dominance of federal funding, the ability of the United States to manage effectively the wide-ranging and complex issues raised by the rapid advance of technology rests on the government, and thus ultimately with the president. This situation has existed since the end of World War II. Before the war, science and technology were primarily private activities. Technological decisions were made by market forces and research decisions were dictated by intellectual curiosity.

Since the war, bureaucratic objectives and military profits have invaded a once benign scene. In addition, increased technical complexity and the imposition of military secrecy have shut out public understanding and participation from decision-making. Thus many technological choices—particularly the major ones—became the sole responsibility of the president.

It is my observation, based on personal experience with the scientific advisory apparatus used by four presidents, that scientific advisory groups always generate major anxieties among other groups in the government, as well as industrial firms looking for work.

Basically the question of who provides the advice boils down to a competition for control of presidential decisions. For a president, the task is to adjudicate the rivalries among many contenders who join together only to confront him. The challenge is to retain control of his information sources and thus his freedom of decision.

I watched at close range the game played by the Pentagon against all four presidents; for example, practically the only times the members of the Joint Chiefs agreed was when they were attempting to persuade the secretary of defense or the president to accept their proposals. Otherwise, in their advisory capacity, one could always predict their position on any subject by identifying the vested interest of their individual service. And because so many of the dominant issues of our times involved military technology, the perceived need for secrecy has been added to the obvious barrier of technical complexity.

President Truman faced the question of technical decision-making as soon as World War II ended. Troubled by inter-service battling over which of them should have the responsibility for the many new technologies that were evolving, and especially by the continuing controversies about nuclear weapons, Truman commissioned a study of how to get himself better information and advice. He persuaded William Golden, a prominent lawyer who had had considerable experience with the wartime Navy Department's research and development efforts to study the problem and make recommendations about what to do. In the fall of 1950, Golden filed a report that proposed a full-time scientific adviser to the president, to be assisted by a scientific advisory committee of highly qualified scientists. The opponents of Golden's plan succeeded in weakening it. The new committee, established in 1951 by Truman, was placed under the director of the Office of Defense Mobilization instead of reporting directly to the president.

It took the shock of the Soviet Sputnik in 1957 to realize the Golden proposals. Eisenhower was upset by how little he had been told about the difficulties of the American satellite, Vanguard.

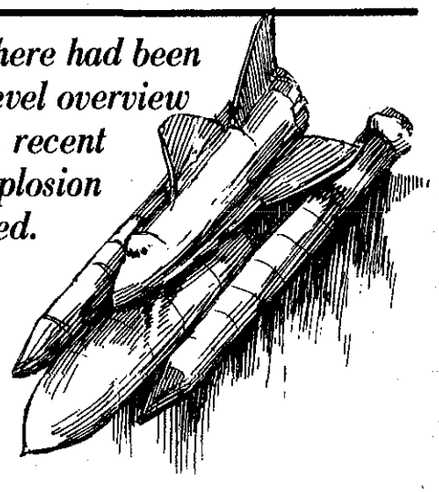
His solution, used soon after the launching of Sputnik in the fall of 1957, was to appoint Dr. James Killian as his special asssitant for science and technology and move the aavisory committee into the Executive Office of the President, where it could provide him with independent evaluation of the government's many scientific programs. Its members quickly developed a close rapport with the president, who turned to it frequently for help. President Eisenhower provided Killian with a letter of appointment spelling out, in great detail, his responsibilities and giving him wide-ranging authority. When George Kistiakowsky replaced Killian in 1960, he followed the operating procedure established by Killian.

When I became science adviser to President Kennedy in 1961, he used this same letter to define my responsibilities. This essentially gave me total oversight of all science and technology programs in the government and in related education programs.

In the Eisenhower-Kennedy period, a major role of PSAC and the president's special assistant for science and technology was to screen the avalanche of military and space projects confronting the president and attempt to provide sufficiency within a manageable budget. Such a task can be done only by a technically competent group totally without vested interest.

In 1958, as Eisenhower became increasingly dedicated to halting the arms race, he asked the Science Advisory Committee to help him. I vividly recall the drama of the moment. Referring to the 1957 Gaither Panel's report on the consequences of nuclear war, he pounded his desk and said, "You can't have that war. There aren't enough bulldozers in the country to scrape the bodies off the streets. Why don't you help me prevent it? Neither the Defense Departmentnor AEC will give me any help. They have other interests."

I am convinced that if there had been adequate presidential-level overview of technical programs in recent times, the Challenger explosion would not have happened.



With this challenge, many of us on the PSAC turned our attention to the technical questions of the test ban and other disarmament efforts. The PSAC was the President's main source of technical information on arms-control and also, which was important to its ultimate fate, the target of the weapons advocates' wrath, a situtation that continued as long as PSAC survived.

Without planning to do so, PSAC also became the ombudsman for federal science and technology programs. The staff became a group to whom workers on government programs, aware of faulty designs, poor manufacturing, inadequate perfomance, unnecessary programs, or other problems could appeal when their concerns were ignored within their own organization. Scientists and engineers realized that the PSAC staff provided a channel that they could use with the confidence that they were not risking the traditional fate of the whistle-blower. We made no effort to encourage this channel, but neither did we discourage it. Robert McNamara once asked me how it was that the few people in my office knew much more about Department of Defense R&D and procurement difficulties than he did with his large staff.

I said earlier that I am convinced that if there had been adequate presidential-level overview of technical programs in recent times, the Challenger explosion would not have happened.

Although the immediate cause of the Challenger disaster was the explosion of a solid-fueled rocket, the real reason for the failure was that President Reagan did not have his own technical-review team. All of the groups involved were under extreme pressure to maintain a launch schedule at all costs. They ignored numerous warning signals. In technical jargon, the president had no feedback. He received no independent information or advice to help him judge Challenger or any other technical program for which he was responsible, or for that matter the soundness or need for any of the proposed new programs that flow into the White House continuously, such as most notably, the Strategic Defense Initiative.

Reagan did not create this situation; he inherited it. It was President Nixon who abolished the Science Advisory Committee and the post of Special Assistant to the President for Science and Technology. He got rid of them because he did not like the advice that they were providing on issues ranging from the controversial anti-ballistic-missile system and the proposed supersonic transport aircraft to the performance of military equipment in Vietnam. Their evaluatons were negative, while he was getting more optimistic information from other sources. He finally abolished PSAC and the post of science adviser after a few frustrated members of PSAC—wrongly, I believe—publicly opposed the ABM and supersonic transport. In doing this, they violated the long-standing and proud tradition of confidentiality of the Science Advisory Committee.

Nixon did not want to hear the facts. In a sense, he chose to kill the messenger. In later years Presidents Ford and Carter made arrangements to get their own assistance on technical questions. Ford faced an anti-PSAC bias that lingered on after Nixon and so never was able to create an adequate advisory system. Carter appointed a special assistant for science but didn't reestablish a Presidential Science Advisory Committee with anything like the extensive capabilities of the original committee.

Reagan's operating style dictates altogether different ways of making technical decisions. He uses the buddy system, which in the end, proved disastrous. Reagan has made no effort to get independent advice about technical questions such as the shuttle, or SDI, perhaps because he did not know that he needed it. He trusted the advocates who had surrounded him during his campaign for the presidency, and he heeded their advice.

It is true that a number of very good scientists refused Reagan's offer of appointment to the position of science adviser when they learned about the limited role they were going to have, and especially that their information and advice would flow to the president mainly through his chief of staff; that in fact they were being asked to be an adviser to a presidential aide. They might have made a difference. George Keyworth accepted the position despite the limitations and thus served the president and the country poorly.

What can be done to reverse the decline in the U.S. technological well-being? We are faced with two separate challenges. First, the president must resume control of the federal scientific enterprise. He must take back control and oversight of these vast resources from the military/industrial complex. Second, we must simultaneously revitalize the civilian science and technology enterprise, all of it—education, basic research and civilian application of technology. We should buy only the few military systems needed to insure national security and direct the rest of our vast technical resources to rebuilding the nation's civilian industrial base.

An essential part of this task is to build the presidential science advisory mechanism back up in a way that would regain the confidence of the Congress and general public in the government's decision-making process. This will not be easy, given the recent history. But it must be done.

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An important determinant of the competitiveness of a country's products in international markets is the amount of R&D invested to develop and produce them. "Process" R&D enhances competitiveness by reducing cost, while "product" R&D does so by improving product quality and reliability. Now, the U.S. devotes almost exactly the same share—about 2.6%—of its gross national product to R&D investment as do Japan and Germany. (The U.K. and France have a somewhat lower R&D investment share, about 2.2%.) But a substantial fraction of the R&D investment of the U.S., the U.K. and France is military in orientation. According to official estimates, about 27% of U.S. and U.K. R&D investment, and 21% of French R&D investment, is military.

These estimates are based on the assumption that the government sponsors military R&D, which for the U.S., at least, is clearly false. Defense contractors devote a substantial fraction of their own R&D personnel and facilities to the preparation of technical proposals that are the basis on which the Pentagon awards competitive contracts for major weapons systems. The true share of (government plus private) military R&D in total U.S. R&D investment is probably about 35% to 40%. In contrast, less than 4% of Germany's, and 1% of Japan's, R&D investment is military. These low shares reflect the deliberate policy on the part of the victors of World War II that the reconstructed Japanese and German economies would exclude defense sectors. Military research and production would be the province of the wartime Allies.

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Mr. Lichtenberg, an associate professor at the Columbia University Graduate School of Business, is affiliated with the National Bureau of Economic Research.

Defense Research Aids U.S. Industry

Scientific Spinoffs From Federal Laboratories Find Wide Usage

By Sue Major Holmes
Associated Press

ALBUQUERQUE—When drill bits chew through layers of hard rock seeking oil, it's a punishing procedure that becomes more expensive as the rock loosens the diamonds on the bit and eventually causes them to drop off.

But now there is a new type of bond to keep the diamonds on.

Similarly, insulated tubing can carry steam down a bored well to loosen hard-to-get oil deposits, but the benefits of the insulation are nearly lost because heat escapes through the uninsulated couplings.

Now there is an inexpensive way to insulate the couplings.

These, according to Glenn Kuswa of Sandia National Laboratories here, are just two examples of the hundreds of instances of technology being transferred from the government laboratories to business.

In the past few years, innovations increasingly have been moved from the federal laboratories where they were engineered to the private sector where they could be developed and marketed.

A large share of the nation's research funds have been invested in the laboratories, and Congress and the public are demanding more from their dollars, Kuswa said. While much of the money goes into weapons, even defense science can be spun off into other areas, he said.

And technology transfer benefits the government, as well.

"In working with industry, there's a lot of passing back of information that is very valuable," he said. "We may develop information; they may make improvements."

In 1980, Congress passed the Stevenson-Wydler Act, which promotes private sector use of federally developed technology.

The national laboratories have some advantages in developing technology, Kuswa said. Government research and development can take on projects that involve expense and high risk over a long time or can do research that smaller business cannot afford, he said.

The laboratories have built up "a technical base that's second to none," Kuswa said. "Academically oriented people work in a field their whole careers without dislocation. Only large industry can afford similar research labs."

But, he said, developments from the national laboratories have to get out to industry before they can help the nation's economy.

Sandia and one of its lab employees, Richard Braash, received the American Wind Energy Association's technology transfer award in 1984 for a verticle-axis wind turbine that is manufactured by several U.S. companies. The same year, Industrial Research magazine cited a corrosion-resistant glass that Sandia developed to extend the life of batteries for weapons. The glass is being used commercially to add to the life of special-use batteries, such as those in heart pacemakers.

Sandia also took computer microchips designed by industry, developed ways to harden, or shield, those chips from radiation, then turned that technology back to companies to market, Kuswa said.

He emphasized that Sandia exists to work on national defense, and innovations or aid to industry are made in that context.

"For example, Sandia does not do any biology, but that doesn't mean we couldn't help in biology," he said.

He pointed out that so-called "smart weapons" are programmed to detect a target and hone in only on that target—image recognition computer technology that someday might help biologists in spotting certain chromosomes he said.

And the scientists who design the weapons must use extremely accurate mathematical calculations. The algorithms, or repetitive calculations, developed from that work have been turned over to industry, providing speed and accuracy not possible with traditional math tables of values, Kuswa said.

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Inman Quitting Top Position at High-Tech Firm

WPost 9/5

By Michael Schrage
Washington Post Staff Writer

Retired admiral Bobby Ray Inman, a former National Security Agency director and CIA deputy director, is resigning as chief of Microelectronics and Computer Technology Corp., the Texas-based high-technology consortium formed in response to Japan's advanced computer successes.

Inman, 55, who recently served on a government commission examining the security of U.S. embassies, chose not to renew his contract and said he will leave after four years as head of the 21-company consortium exploring new computer designs and semiconductor technologies.

Inman announced his resignation at MCC's board meeting in Austin, Tex., Wednesday.

"It came as a surprise to all of us," said Samuel H. Fuller, Digital Equipment Corp.'s representative on the board. "My reaction is that he did an outstanding and unique job moving MCC from dream to reality."

Inman, recruited as MCC's first chief executive officer in 1983 after leaving the CIA, used his high Washington profile to lobby against antitrust rules that had prevented companies such as Advanced Micro Devices, RCA Corp. and Control Data Corp. from performing joint research.

Fuller and other MCC board members reported that Inman said he had no firm plans. Inman was unavailable for comment.

In a statement, he said he is concerned about the speed at which U.S. companies apply technology and that future activities are likely to "center around this very critical element in the U.S. ability to compete in the international marketplace."

Changing Role of Federal Labs

Inhibitions limiting use of federal laboratories by industry disappearing; collaboration increasing

BY H. DANA MORAN*

About one-sixth of all national research and development in the United States is conducted in Federal laboratories. Federal laboratories account for a significant fraction of America's science and technology enterprise. Yet, historically only a small proportion of the new technology developed in these laboratories has been brought to the private sector. The reasons have been many: classification of information; apprehension of dealing with the United States Government; controls on access to publicly-owned inventions; delays in publications; lack of publicity. But whatever the reasons, national laboratories have represented a substantially underutilized resource for private industry.

Recent developments in Congress, the administration, and in the federal agencies are changing this picture. Beginning in 1980, Congress initiated a series of changes in patent law and in policies governing the management of intellectual properties resulting from publicly-funded research and development. The present administration has endorsed and supported these changes. Federal agencies have implemented them, resulting in significantly improved access by private industry and a forthright commitment to facilitate commercialization of developments emerging from the laboratories.

As executives responsible for the acquisition and disposition of rights in new technologies, these developments can be important to you and your companies. I'll discuss the significant actions which have brought about this enlightened environment for technology transfer and highlight some results.

FEDERAL LABORATORIES

First, let me define my terms. By "federal laboratories" I mean those institutions chartered by U.S. government agencies to conduct research, development, testing and related activities. The Government Accounting Office has identified 755 such facilities, ranging in size from 8,000 employees to less than five staff members. Of those, 388 have a specific and continuing research mission. These laboratories account for about one-third of the federal research and development budget — $20 billion in 1986. Most are government-owned and government-operated facilities — GOCO's in bureaucratic jargon. Fourteen agencies support these laboratories (Table 1).

FEDERAL LABORATORIES BY AGENCY

Agency	Number of Labs	Total* Staff	Average Lab. Staff
DOD	92	89016	968
DOE	39	64544	1655
NASA	11	24885	2262
DOI	24	13482	562
HHS	21	8540	407
USDA	67	7786	116
DOC	36	5077	141
DOT	7	2625	375
NSF	6	1641	274
EPA	14	1565	112
TVA	4	1404	351
VA	60	600+	10+
DOJ	1	429	429
Smithsonian	6	291	48
	388	221,885	572

*Estimate

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Manager, Industry Affairs, Solar Research Institute, Golden, CO; paper presented at LES U.S.A./Canada Annual Meeting, October 1985.

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P.L. 98-620 has significant implications for industry. Access to new technologies developed in the contractor-operated laboratories will be more readily available. The laboratories may convey exclusive rights, and may enter into license agreements which provide for shared rights in future developments. The laboratories can cooperate in such further developments, providing access to facilities and staff as appropriate. Several hundred new inventions will be available for license each year, and, with approval of the sponsoring agency, such access through the laboratory may be retroactive, including patents applied for in previous years.

It should be noted that the implementation of policies such as this depend on the issuance of "implementing regulations." The Department of Commerce was assigned the task of preparing those regulations. Draft regulations were published in April 1985, with comments due by June 3. Such comments have been compiled, and it is expected that the implementing regulations will be issued soon.

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It is the royalty provision, which has made these proposals controversial. Industry views the plan to reward government employee inventors as a possible threat, because it could encourage legislation requiring similar compensation to private inventors. There is also expressed concern that commercial interests could distract government employees from their primary missions.

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In this context, two other pieces of recent legislation should be mentioned; Public Law 98-525, the "Defense Authorization Act of 1985," and Public Law 98-577, the Small Business and Federal Procurement Competition Act of 1984. Both contain provisions with regard to contractor rights to "technical data," which is defined as including computer software. Since computer software is a licensable product, those rights can be valuable assets in technology transfer. For a more complete discussion of the implications of these new laws, I refer to an article by

SUMMARY

Federal laboratories play a major role in the national research and development program; they are a vast resource of new technology which can lead to improved — and profitable — products, processes and services for industry. But a variety of institutional inhibitions have limited the use of this resource by industry. That picture is changing, rapidly. Congress is providing the legislative tools, the administration is providing the policies, and the agencies are providing the processes, to allow and encourage industry to work in close harmony with the federal laboratories. The laboratories now can meet with industry on common turf, sharing their skills, facilities and intellectual developments with industry partners.

These developments have created a whole new ballgame in the "government-industry partnership." Technology transfer is not only the name of the game; it also is the prize for the players.

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Changing Role of Federal Labs

Inhibitions limiting use of federal laboratories by industry disappearing; collaboration increasing

BY H. DANA MORAN*

About one-sixth of all national research and development in the United States is conducted in Federal laboratories. Federal laboratories account for a significant fraction of America's science and technology enterprise. Yet, historically only a small proportion of the new technology developed in these laboratories has been brought to the private sector. The reasons have been many: classification of information; apprehension of dealing with the United States Government; controls on access to publicly-owned inventions; delays in publications; lack of publicity. But whatever the reasons, national laboratories have represented a substantially underutilized resource for private industry.

Recent developments in Congress, the administration, and in the federal agencies are changing this picture. Beginning in 1980, Congress initiated a series of changes in patent law and in policies governing the management of intellectual properties resulting from publicly-funded research and development. The present administration has endorsed and supported these changes. Federal agencies have implemented them, resulting in significantly improved access by private industry and a forthright commitment to facilitate commercialization of developments emerging from the laboratories.

As executives responsible for the acquisition and disposition of rights in new technologies, these developments can be important to you and your companies. I'll discuss the significant actions which have brought about this enlightened environment for technology transfer and highlight some results.

FEDERAL LABORATORIES

First, let me define my terms. By "federal laboratories" I mean those institutions chartered by U.S. government agencies to conduct research, development, testing and related activities. The Government Accounting Office has identified 755 such facilities, ranging in size from 8,000 employees to less than five staff members. Of those, 388 have a specific and continuing research mission. These laboratories account for about one-third of the federal research and development budget — $20 billion in 1986. Most are government-owned and government-operated facilities — GOCO's in bureaucratic jargon. Fourteen agencies support these laboratories (Table 1).

*Manager, Industry Affairs, Solar Research Institute, Golden, CO; paper presented at LES U.S.A./Canada Annual Meeting, October 1985.

FEDERAL LABORATORIES BY AGENCY

Agency	Number of Labs	Total* Staff	Average Lab. Staff
DOD	92	89016	968
DOE	39	64544	1655
NASA	11	24885	2262
DOI	24	13482	562
HHS	21	8540	407
USDA	67	7786	116
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CAN ROGER SMITH CHANGE GENERAL MOTORS' CULTURE? PAGE 84

BANKS' HOW POWER IS SHIFTING PAGE 56

BusinessWeek

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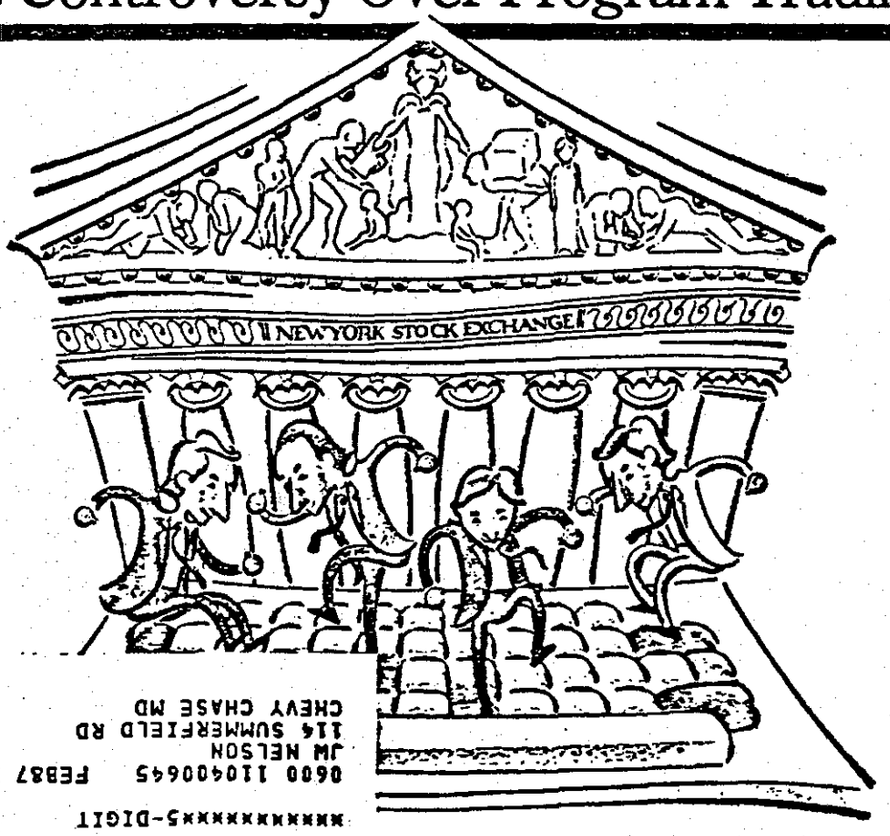
THOSE BIG SWINGS ON WALL ST.

The Controversy Over Program Trading PAGE 32



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AMERICA CAN BEAT ANYONE IN HIGH TECH. JUST ASK BRUCE MERRIFIELD

BUT THE COMMERCE DEPT. CRUSADER FOR A NEW ERA OF R&D MAY SOON BE OUT OF A JOB



MERRIFIELD'S BRASH EFFORTS TO AID THE HIGH-TECH INDUSTRY ALIENATED THE REAGANITES

"If you believe in astrology, Geminis are manipulative, pretty damn clever, and very success-oriented," observes a Commerce Dept. official. D. Bruce Merrifield is a Gemini, and those characteristics contributed mightily to his success as the Reagan Administration's most effective advocate of U.S. technological competitiveness. As Assistant Commerce Secretary for productivity, technology, and innovation during the past four years, Merrifield led the fight to modify antitrust law to permit cooperative research among competing companies, stimulate the growth of research and development limited partnerships, and launch discussions with 38 countries on cooperative agreements for developing technology.

So why has the Administration marked his office for extinction next year? The official answer is that it has accomplished what it was set up to do. Insiders see it differently. They say Merrifield has been so manipulative, clever, and successful that he made enemies in his own department, at the White House science policy office, and—most important—in the Office of Management & Budget. Merrifield, says one industry research director, "never learned to live in the Washington climate; he didn't smooth the feathers he needed to."

Yet Merrifield's zeal has made him a hit on Wall Street and a hero to CEOs of both major corporations and tiny, high-tech startups. "He has a real vision, you know," says one colleague. "He's really sort of the prophet of high technology." Indeed, 64-year-old Merrifield preaches his sermon to all who will listen and to some who would rather not. "There is no excuse for us to lose the leading edge in technology," he says. "The U.S. can outrun anybody, any place, any time if we just get our act together." All that's needed, he believes, is to tap the innovative technology created by startups and remove roadblocks to intercompany cooperation on important R&D projects.

The chance to help the U.S. do just that induced Merrifield in 1982 to leave Continental Group, where he was vice-president for technology and venture management, and resign as president-elect of the Industrial Research Institute, a group of corporate-research managers. He took charge of a tiny corner of the Commerce Dept. known as the Office of Productivity, Technology & Innovation (OPTI), with only two dozen employees and a budget of about $2 million.

Although Merrifield holds master's and doctoral degrees in physical organic chemistry from the University of Chicago, his message is laced with economics. He insists that while many of the top industrial corporations are "going down the tubes," thousands of high-tech start-ups are ready to take up the slack. "The climate for entrepreneurship and productivity is bringing about a total restructuring of the economy," he says.

The problem, according to Merrifield, is that this growth is "pretty much invisible." Even though the U.S. is creating almost 700,000 new companies a year, 80% of them go unnoticed because the Census Bureau does not count companies with fewer than 20 employees. Merrifield also argues that the OMB's Standard Industrial Classification codes are hopelessly outmoded. "Silicon chips and computer software are listed in a category of stone, glass, and clay, and there is no code for biotechnology," he says. "The bureaucrats are turning a crank that's 30 years old."

A TRICK OR TWO. Cracks like that have earned Merrifield few friends in the warrens of Washington. Moreover, his proposed solutions sound suspiciously like "industrial policy" to Reaganites opposed to government intervention in the marketplace. Even so, he has won some important battles. The most significant: He engineered changes in U.S. antitrust laws to allow rival companies faced with foreign competition to undertake joint R&D projects. "Everyone thought I was crazy," Merrifield says.

That victory required more than a year of battling to convince William F. Baxter, then head of the Justice Dept.'s antitrust division, that change was needed. Merrifield was not above a trick or two to get the job done. He once planted retired Admiral Bobby R. Inman, who heads a research consortium of major electronics and computer companies called Microelectronics & Computer Technology Corp. (MCC), in the audience during a Baxter speech. When Baxter commented that it was only a perception that antitrust law was a barrier to such research co-ops, Inman "jumped up and

said, 'When are you stupid people going to get your heads screwed on right?' " Merrifield recalls. "For the first time, Baxter admitted there might be something to what I had been saying."

Merrifield's next stop was Capitol Hill, where House Judiciary Committee Chairman Peter W. Rodino Jr. (D-N.J.) said he was not interested in altering antitrust law. So, says Merrifield, "I cited six horrendous cases of Justice Dept. intervention in attempts to do cooperative research." And when Senator Howard M. Metzenbaum (D-Ohio) threatened a filibuster, Merrifield got 77 senators to co-sponsor the bill and made impassioned speeches in Cleveland and Akron. That, says Merrifield, caused the senator to change his mind.

'ZEROED OUT' Whether Merrifield has embellished his account or not (Metzenbaum's office disputes his version), the National Cooperative Research Act of 1984 passed. Since it became law about a year ago, some 40 research consortiums, including Inman's MCC, have registered with Justice and the Securities & Exchange Commission. Some are using another Merrifield idea—financing their efforts with R&D limited partnerships. Wall Street likes the idea. PaineWebber Inc., for one, is raising $100 million to finance such partnerships.

The OPTI chief has also lobbied hard for laws that will allow the private sector to own patents on inventions developed with government money and he has sought retraining for workers laid off by dying industries. Merrifield wants the National Technical Information Service, which he oversees, to create a "one-stop, world-scan data base" to let U. S. companies tap foreign technology. "A decade ago we created 75% of the world's technology," he says. "That's now down to 50%, and soon it will be one-third."

When Merrifield is not riding circuit with his sermon, he continues to ruffle feathers in Washington. He recently warned the Agriculture Dept. that while it is worrying about plummeting farm exports, it is ignoring the need for new agricultural technology. Such incursions into others' bureaucratic turf may have cost him critical points. Merrifield's office "really did play hardball up here," grouses one congressional aide. "They burned some people and may well get burned in return." His meaning was clear: If the budget office "zeroes out" OPTI as it did last year, Congress this time may not restore the funding.

Merrifield seems unperturbed. Echoing the OMB's rationale for shutting down his office, he says: "No problem. There are times when I think maybe I've done what I can here." But, adds a colleague: "It's amazing that he has run loose this long."

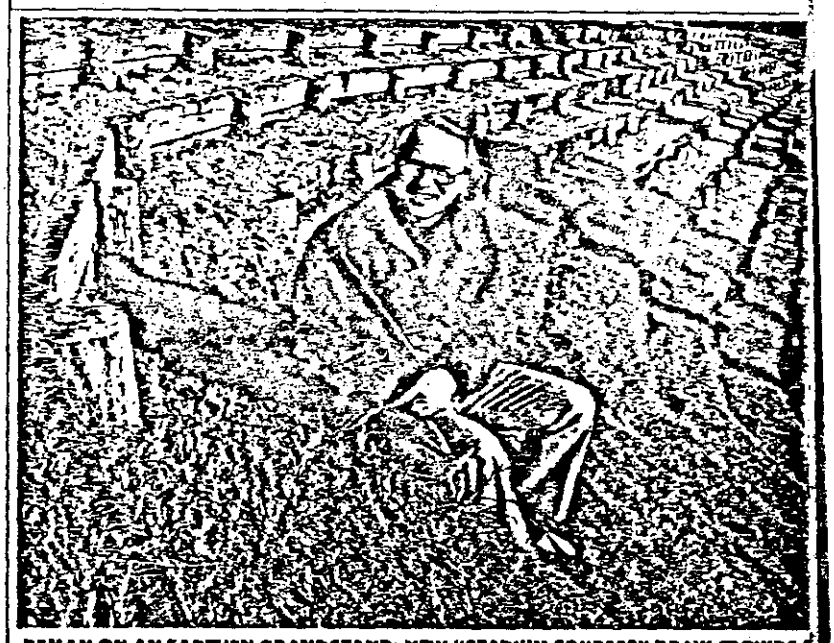
By Evert Clark in Washington

JOHN HANSEN

GOLF

HOW THE PGA IS STAYING OUT OF THE ROUGH

FEARING A DEPENDENCE ON TV, COMMISSIONER BE EXPANDED INTO MARKETING AND EVEN INTO REAL E



BEMAN ON AN EARTHEN GRANDSTAND: NEW "STADIUM COURSES" DRAW CROWDS

Golf has one feature that's unique among major professional sports: Its spectators have a hard time seeing what's going on. The trouble is that golf courses—until recently—were designed to accommodate the players, not the watchers. But when Deane R. Beman, a top-ranked touring professional, was named golf commissioner 12 years ago, he made it one of his goals to change that.

Has he ever. He invented the stadium golf course. The earth that's bulldozed out for water hazards and other features is used to build spectator mounds along the course and earthen grandstands at the first tee and 18th green. Beman hopes this perfectly simple idea will go a long way toward ensuring that professional golf has a golden future.

RENT A TENT. Today there are 12 such courses, all operated by the entity Beman heads, PGA Tour Inc., and 12 more are planned. The record shows that the new courses attract bigger crowds: Some 50,000 people a day are expected at the last two days of the Tournament Players Championship at the PGA's prototype stadium course in Ponte Vedra, Fla., the last weekend in March. Bigger crowds mean greater ticke and concession revenues. tournaments also attract cor rent tents in which they sell from golf gear to life insu larger the crowds, the greate tive to rent a tent.

It all means more money, the name of the game f though the tour is a nonprof tion. When he took over the had assets of $730,000 and income of $3.9 million, virtua the sale of television rights. commissioner, then 35, that ening. It meant that the gam was in the hands of the netv

He was determined to b revenue base—and he's gone toward that goal. The tour is in marketing and merchandis tate development, golf-cou tions, and TV production. It h ated a new product, the Senio pro golfers over 50. Last ye Tour, with assets of $41.6 m total revenues of $48.3 millio $16.4 million came from tele

PGA Tour, as distinct from sional Golfers' Association o

Inside U.S. Trade

An Inside Washington Publication

An exclusive weekly report on major government and industry trade action

Vol. 4 No. 7 February 14, 1986

SPECIAL SUPPLEMENT

WHITE HOUSE EVALUATING R&D PLAN TO RETAIN EDGE OVER FOREIGN TECHNOLOGY

The Administration is evaluating a comprehensive set of recommendations to increase research and development in order to preserve a U.S. lead over foreign technology, informed sources said. Without these incentives, the White House fears the U.S. will lose its competitive edge to countries that target industries for development. The plan includes changes for the research & development tax credit and a uniform federal copyright policy that would give all government contractors ownership of technical data in exchange for royalty-free use by the government, according to a copy of the plan made available to *Inside U.S. Trade* and reprinted below. The r&d recommendations were reviewed by the cabinet-level Economic Policy Council, which sent them back to the Treasury's Office of Tax Policy to evaluate their effect on revenue, one informed source said. The recommendations were drawn up by the Working Group on Research and Development, which was chaired by Manuel Johnson, the assistant secretary for economic policy at the Treasury Dept. The document was initially drawn up for a Dec. 19 EPC meeting.

The working group made four recommendations, emphasizing that it is important for the U.S. to increase its efforts in all phases of r&d. The recommendations say this will strengthen the competitiveness of U.S. goods and services, increase productivity and economic growth, reduce the rate of inflation and create new jobs. The group recommended: 1. a fixed base for the r&d tax credit, adjusting its rate to maintain revenue neutrality; 2. a uniform federal copyright policy that gives federal contractors ownership of technical data; 3. an increase in the incentive for researchers in government laboratories to transfer technology to the private sector for commercialization; and 4. a directive for all major r&d agencies to build up university-based scientific and engineering research that bears on technology and industrial competitiveness. It also proposed that the Administration explore whether it should use a competitive bidding process to fund federal r&d projects, according to the document.

Incentives for r&d are necessary to keep the U.S. competitive with other countries, the working group pointed out. Generally, the private market provides enough incentives for firms to fund r&d to sustain rapid rates of innovation, the group said. However, this is not true for basic research, where there may be significant underinvestment. In that case, government should provide incentives to stimulate investment in r&d, the group said. Antitrust, patent and copyright policies also can help lower some of the barriers to private innovation and r&d, enabling U.S. firms to compete more effectively in domestic and international product markets, the paper said. "Government procurement activity can provide a large market for private output and in the process influence the development of new technologies and encourage the investment necessary to apply it," the group said.

The r&d tax credit, which expired in December, should be based on a fixed annual base adjusted for inflation, the working group recommended. The current tax credit contained in the House tax bill provides a 25% credit on the part of a corporation's r&d that exceeds the average r&d expenditures for the three preceding years. Figuring the credit over such a constantly increasing three-year base may provide less incentive for increases in r&d than alternative arrangements, the working group said. Advocating this change may prove politically awkward, the group said, because Treasury late last year negotiated with the House Ways & Means committee about an extension of the credit and agreed to a constantly increasing base. "However, it is appropriate to consider changes in the incremental structure that could increase considerably the marginal incentive while maintaining revenue neutrality," the group said.

Following is the text of the recommendations sent to the EPC by the working group on r&d:

existing ones. Industrial innovation — the development and commercialization of R&D — accounts for a significant part of our increased productivity, which helps to reduce the costs of producing goods and services and is responsible for a sizable share of the Nation's economic growth. It is critical that the United States continue to increase its efforts at all phases of R&D in order to increase productivity and economic growth, reduce the rate of inflation, create new jobs, and strengthen the competitiveness of U.S. goods and services.

R&D is itself an important component of the U.S. economy, accounting for an estimated $106.6 billion or 2.7 percent of the Gross National Product (GNP) in 1985.

Twenty years ago the U.S. clearly had a lead over other countries in the share of the GNP allocated to total R&D spending. Over the past 20 years, however, there has been a convergence between the U.S. R&D/GNP ratio and the ratio in other countries.

A relatively high degree of risk is generally associated with many aspects of R&D. In addition, all of the benefits from some types of R&D, particularly basic research, may not accrue to private investors although they would be available to society as a whole. In such cases, there may be significant underinvestment of private resources in R&D, and society is the loser. The presence of externalities — the availability of benefits to a broader group than the private investor undertaking the R&D — has long been viewed as justifying government intervention in the R&D process, particularly basic research.

Government policies can have a significant influence on R&D and innovation. Tax incentives, for example, can be used to reduce the cost of R&D activities to firms, thereby making such activities more attractive. In addition, antitrust and patent and copyright policies can help lower some of the barriers to private innovation and R&D and enable firms to compete more effectively in domestic and international product markets. Government procurement activity can provide a large market for private output and in the process influence the development of new technologies and encourage the investment necessary to apply it.

Other factors are thought to also have a significant impact — both positive and negative — on R&D and innovation. Expectations about macroeconomic conditions and the intensity of competition, both domestic and international, are particularly important. A strong, robust economy encourages investment and innovation; it generates increased business cash flow to help finance R&D internally, rather than by borrowing, and makes it easier to market new products.

In a strong economy innovations are diffused more rapidly throughout the economy because new capital equipment and new processes are likely to embody improved technology. Also, increased investment tends to encourage innovation in the capital goods industries by increasing the demand for business investments. Alternatively, a robust economy may lessen the urgency to pursue new products and processes, while slack economic conditions can provide an incentive for businesses to seek out new technologies and processes to help reduce costs of production. On balance, the evidence suggests that R&D spending is positively correlated with economic growth.

The Administration has been very supportive of R&D, particularly basic research where, because of significant externalities, the private sector may be underinvesting. Between 1981 and 1985, Federal investment in basic research will have increased by almost 30 percent in real terms. The Administration also worked with the Congress to enact the National Cooperative Research Act of 1984, which permits two or more persons to undertake joint research and development ventures with less concern that such cooperative efforts will be found to be in violation of our antitrust laws.

The current budgetary situation may require that R&D, like most other government programs, share in the need to scale back the growth of spending. Nevertheless, a reallocation of the government's R&D resources toward multidisciplinary long-term research on basic technologies would increase the effectiveness of the U.S. research effort. At the same time there are ways in which the Federal Government can encourage increased R&D efforts by the private sector without adding to the budget deficit, and in fact would help reduce the deficit through increased economic growth, job creation and lower inflation.

The Working Group on R&D reviewed a number of proposals for encouraging R&D. These proposals involved issues concerning the cost of R&D capital, regulatory and legal barriers to R&D and public/private R&D relationships.

The Working Group reviewed the possibility of further [including] the capital gains tax but did not include it in the Group's recommendations because of the current status of consideration [of] the President's proposal for tax reform. However, this change should be considered at a later time.

The following are four unanimous recommendations and one exploratory proposal of the R&D Working Group for encouraging industrial investment in research and development and improving the effectiveness of our overall R&D effort.

Recommendation 1. Improve the Structure of the R&D Tax Credit

Problem/Issue

The existing tax credit for research and experimentation is intended to provide a real incentive for additional (incremental) R&D. The Treasury Department has just negotiated with the House Ways and Means Committee an extension of the R&D credit. This could make it awkward to initiate a major revision in the credit at this time. However, it is appropriate to consider changes in the incremental structure that could increase considerably the marginal incentive while maintaining revenue neutrality.

Background/Analysis

The R&D tax credit is intended to give companies incentive to increase their R&D efforts. Otherwise firms are likely to underinvest in R&D because of its potential externalities and delayed return on investment. The current credit establishes such an incentive by providing a 25% credit on the increment of a corporation's R&D for the taxable year over the average of its R&D for the three preceding years. In other words, the credit is 25% of the increment over a "creeping" three-year R&D base.

This "creeping-base" structure may provide less incentive for increases in R&D than alternative structures. The basic reason for this is that the additional R&D performed in the current year will increase the base in each of the three succeeding years, thus reducing the credit the company could claim in subsequent years for maintaining that level of R&D.

This incentive effect of the credit could be increased by a shift to an "indexed base" structure. The credit would continue to be allowed on the increment over a base. Instead of a moving base consisting of R&D for the three years immediately preceding the taxable year, however, the base would be R&D for a fixed three-year period, indexed annually for inflation or some other indexing factor different from the company's own R&D record. Research indicates that with appropriate accompanying adjustments such a structure could provide several times the marginal incentive for extra R&D without increasing the revenue loss.

This alternative structure should be examined carefully by tax and R&D experts and, if it proves practicable and administrable, implemented.

Recommendation

Treasury, in collaboration with other interested agencies, should consider an amendment that:

- **incorporates the "indexed fixed period base" structure;**
- **maximizes its incentive effect;**
- **minimizes any associated problems;**
- **adjusts the credit rate to maintain revenue neutrality equivalent to present law.**

on whether such an amendment would have policy or political drawbacks.

Recommendation 2. Ownership of software and other Technical Data Produced Under Contract to the Federal Government

Problem/Issue

Many types of commercially valuable information such as computer software, engineering drawings, etc. are generated under Federal grants and contracts or in conjunction with them. Agencies now have a multiplicity of policies governing copyright ownership of this information. Such information often has great commercial importance to the private sector. However, the threat that the Government will hold all copyrights that derive in any way from work produced under contract can have a chilling effect on private sector participation in Government funded research projects. Copyrightable information developed in Government funded research projects does not receive the same protection afforded patentable products or processes developed under the same circumstances. This threat is especially great to researchers seeking to commercialize valuable copyrights such as software programs.

Background/Analysis

Passage of the Bayh-Dole Act (Public Law 96-517) in 1980 marked a turning point in Federal policy on patent rights to inventions. Congress sought to increase technology transfer from Federal research and development to the private sector by allowing universities and small business contractors to manage patentable inventions they made under Government grants and contracts. Subsequently, a number of university and private contractors have established technology licensing programs. The President's Memorandum on Government Patent Policy, February 18, 1983, extended the principles of the 1980 Bayh-Dole Act to all businesses, consistent with existing law; some medium and large business contractors still do not receive the benefits of this policy because of preexisting laws that were not affected by the 1980 Act. In 1984, PL 98-620 extended the 1980 Act to include most contractors who operated Federal laboratories. However, the [illegible] protection afforded to these contractors and grantees does not extend to copyrightable software and other technical information. The absence of a uniform Federal policy allowing contractor ownership of copyrights that may be generated under grants and contracts in exchange for royalty-free use by the Government inhibits contractors working in fields where such protection is needed for commercialization. This slows the transfer of new ideas to the commercial sector.

Recommendation

A uniform Federal copyright policy should be developed by OMB allowing all contractors (including medium and large size businesses) ownership of software, engineering drawings and other technical data in exchange for royalty-free use by the Government; it could be modeled on the President's memorandum of February 18, 1983. Such a policy would be consistent with the Administration's technology transfer goals by encouraging commercialization of copyrightable products by the private sector. This policy would also encourage the most innovative small, medium and large companies and universities to participate in Federally sponsored R&D projects, thereby benefiting the Federal agencies and the public.

Recommendation 3. Greater U.S. Competitiveness Through Federal Laboratory Cooperation with Industry

Problem/Issue

Federal laboratories perform more than $17 billion in R&D annually and employ about one-sixth of our research scientists and engineers. They represent a substantial yet insufficiently utilized resource for U.S. industrial competitiveness. Furthermore, present Federal pay and incentive systems for [illegible] quired for laboratory missions nor stimulate technology transfer to the private sector.

Background/Analysis

About two-thirds of funding for Federal laboratories goes to government-operated institutions. The rest goes to contractor-operated institutions. At present, both kinds of laboratories have authority to grant exclusive licenses for their inventions to the private sector. However, only contractor-operated laboratories and their employees may receive a share of the royalties. There is little or no incentive for researchers in government-operated laboratories to transfer technology and contribute to U.S. industrial competitiveness. All Federal laboratories share the problem of removing barriers to increased collaborative research with U.S. industry. Issues such as protection of proprietary information and definition of government rights to products of collaborative research have not been fully resolved.

The 1983 White House Science Council's report on Federal laboratories (Packard Report) recommended that: R&D interactions between Federal laboratories and industry should be greatly increased by more exchange of knowledge and personnel, collective projects, and industry funding of laboratory work; provided an oversight mechanism is established to prevent unfair competitive practices.

Legislation is now being considered in Congress to enhance Federal laboratory collaboration with the private sector by giving government operated laboratories the same incentives as are available to contractor operated facilities.

Recommendation

The Administration should take administrative action or propose or endorse legislation that would:

- incorporate contribution to U.S. industrial competitiveness as an explicit laboratory mission wherever that has not already been done and is not inconsistent with the primary laboratory mission;
- allow agencies to delegate significant authorities to their laboratories for managing the technologies they produce, including licensing inventions made by laboratory employees;
- allow the laboratories to further their research objectives by entering into cooperative research agreements with universities and industry that specify what rights the Government and the other collaborators have to any inventions that may result;
- allow inventors and their laboratories to share the royalties their inventions produce as an incentive to move new technologies out of the laboratories and into the marketplace and to do so without reducing incentives to work on mission projects with little or no commercial use.

Recommendation 4. Increase Federal Investment in University Research on Basic Technologies

Problem/Issue

The U.S. has insufficiently tied together our great strength in university research with R&D in industry, and it has underinvested in long-term research on basic technologies.

Background/Analysis

R&D to develop specific products and processes for the market is the job of industry. But industrial firms cannot be expected to fund more than a small share of the type of research that provides the knowledge base for work across whole technologies, particularly those that are new and rapidly developing.

United States research universities lead the world in research and training in the traditional science and engineering disciplines—physics, chemistry, biology, mechanical engineering, etc. However, university basic research has inadequately nurtured research on basic technologies, which is typically multidisciplinary and differently focused from the traditional disciplines. As a result, the U.S. has underinvested in university research on basic technologies. In addition, scientists and engineers trained in a single discipline have been poorly prepared to collaborate in multidisciplinary work that

characterizes corporate R&D. Also, movement of people, and therefore of ideas and know-how, between universities and industry where multidisciplinary research is needed, has been too limited.

The Administration has taken important first steps in addressing this in the University Research Initiative of the Department of Defense and the Engineering Research Centers of the National Science Foundation (NSF) and other agencies. These are helping universities address the needs of the country for more multidisciplinary basic research, and encouraging greatly enhanced collaboration and interaction between universities and industry.

The initial NSF solicitation for multidisciplinary, university-industry engineering research centers, despite relatively short notice, evoked 142 proposals for investing $2.2 billion of Federal funds. The NSF actually had funds enough to establish only 6 centers for $10 million. The universities remain painfully short of resources with which to make the necessary transition.

Recommendation

Within the constraints of the President's budget, all major R&D agencies should be directed to make a stronger commitment to build up university-based scientific and engineering research that bears on technology and industrial competitiveness, especially through multidisciplinary basic science and technology centers.

This would accelerate Administration initiatives already started on a small scale to encourage university fundamental research that is (1) focused more on current or potential technologies than on traditional disciplines, (2) able to attract support from industry as well as Government, and (3) effective in encouraging university-industry collaboration in research and in the movement of people between university and industry.

Heads of agencies with major research and development programs should be directed to report to the President on their specific plans to implement this recommendation.

Proposal: Competitiveness of Federal Applied Research

Issue

Should the Administration explore applying on a demonstration basis to a specific program a bidding process for selecting Federally-funded applied R&D projects close to commercialization?

Background

Clearly, the best approach for financing applied R&D projects close to commercialization is to turn the responsibility for such financing to the private sector. However, the Congress often requires the Administration to finance such projects. Although private firms now share the costs with government in many applied R&D projects and the government consults with industry and academia on the technical and economic feasibility of projects, the government ultimately determines which applied R&D projects will be pursued.

Proposal

A better approach to financing these projects is to assure that the government finances only those applied R&D projects the market believes hold the most promise. Rather than having the Congress or a Federal department determine which specific technologies should be financed and then soliciting private support, the government would solicit bids from private firms on the amount of Federal funds they need to produce a given amount of coal, for example, that would meet certain environmental standards. The government would thus allow the market to choose the specific technologies on which research should be conducted. The firm offering the lowest bid, i.e., asking the government for the least funds, must believe that it has the most promising technology for producing the good. A firm might offer the lowest bid because it has a low-cost technology or it foresees benefits to itself from developing the technology.

The key feature of this system is that the government would award the funds only after the firm demonstrated it could produce the good. With this government guarantee of future payment, the firm could obtain financing by convincing the market that its technology was most feasible. The firm would have to persuade banks, venture capitalists, and individuals that it could produce the good. This system shifts from the government to the market the burden of determining a technology's economic feasibility.

In this system, there would be no immediate budget outlays since the government would not provide the firm funds until it can demonstrate the production of that good. In fact, if the firm fails to produce the good, the government need not provide the funds at all. The government would thus only finance research on those technologies that actually work. If no firm offered a bid to produce the good or if the bids require enormous Federal support, the government would have a signal that the market believes the technologies for producing the good are currently economically infeasible. The government should then either conduct basic research in this field or not conduct research at all.

Advantages

The government finances only those applied R&D projects the market believes are most economically feasible. The private sector is more capable than the government of determining the economic feasibility of projects.

Immediate budget outlays are reduced since the government would award funds for projects only after a firm demonstrates it can produce the good meeting the standards.

Future budget outlays may decline as well since if the firm cannot produce the good meeting the standards, the government does not have to award funds for the project.

Disadvantages

This approach would radically change the system of government selection of applied R&D projects close to commercialization. It would take much time to show the Congress how and why this approach would work.

This approach would likely face strong opposition from Federal departments conducting such research because it would obviate the need for government personnel who now decide which applied R&D projects should be financed.

BUSINESS INTELLIGENCE PROGRAM

DATALOG

March 1986 • No. 120

REPORT

GLOBAL STRATEGIES IN MANUFACTURING INDUSTRIES



Global strategies that build cross-country and cross-regional links are significantly altering the nature of international competition. Multinational companies with separate and largely independent operations in various countries and many large domestic manufacturers are threatened by manufacturers pursuing global strategies. The forces stimulating these global strategies include an international convergence in consumer tastes, an increase in technology innovation and expertise worldwide, and growing new product development risks. Better and cheaper transportation and communications, more flexible mass-production manufacturing, and lower tariffs are facilitating the implementation of global strategies. Movement toward global strategies will foster significant changes in the structure and nature of international competition in some industries, as well as in the management, organization, and operation of multinational companies (MNCs). Manufacturers face difficult challenges in developing and implementing global strategies; obtaining a global perspective—in part by finding executives with global views and experience—is often difficult. *Report* No. 727, **Global Strategies in Manufacturing Industries,** by G. Thomas Wachter, senior consultant in SRI International's Materials and Mechanical Industries Center, describes the forces behind this transition and examines the operational issues that manufacturing firms pursuing global strategies must address. It assesses the implications for and options available to not only the MNCs and their suppliers, but also their domestic competitors, consumers, the labor force, and national governments. Viable strategic options for manufacturers include focusing on markets where customer preferences are likely to retain distinct national characteristics, seeking an accommodation with a major global competitor, seeking defensive trade barriers, and using offshore sourcing and other methods to become competitive.

The reports described on this page will be mailed and will be available to B-I-P members through their companies' B-I-P Executive Contact.

SCAN

NEW PARAMETERS OF LIABILITY

Product liability concepts have undergone significant change over the past ten years, and *Scan* No. 2039 explores the parameters of this new liability doctrine. For one thing, contributory negligence on the part of a plaintiff no longer keeps him or her from winning the suit. Furthermore, product liability has been extended to cover parties other than those directly involved. Professional liability has also spread. Professionals in many areas besides medicine—lawyers, architects, engineers, actuaries, consultants, and even the clergy—are increasingly being held accountable in the courts for undesirable consequences resulting from the practice of their respective professions. Courts attempt to clarify the line of demarcation between individual and organizational responsibility, but the result often appears to

(Continued on page 4.)

This issue: • *Computer-Integrated Manufacturing* • *Aging Work Force* • *New Parameters of Liability* • *Industrial Inspection* • *Global Strategies in Manufacturing Industries*

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BUSINESS INTELLIGENCE PROGRAM

scan

ALERTING BUSINESS TO EARLY SIGNS OF CHANGE

• 2039
January/February
1986

THE NEW PARAMETERS OF LIABILITY

CORPORATE OFFICIALS all over the United States are increasingly facing prosecution, and the murder conviction last summer of three executives of Film Recovery Systems Inc. in Elk Grove Village, Illinois, accelerated the trend. Each executive was sentenced to 25 years in jail for causing the death of an employee who inhaled cyanide fumes at work. They are appealing (*Business Week,* 10 February 1986, page 73).

ARE ACTUARIES NEXT on the malpractice hit list? Recently, the Pension Benefit Guaranty Corporation (PBGC) sued the George D. Buck actuarial consulting firm, charging that Buck was unreasonably optimistic in calculating the probability of shutdowns at Mesta Machine Company. The PBGC had to cover the pension shortfall when shutdowns occurred (*Forbes,* 21 October 1985, page 102).

JOB-STRESS CLAIMS have substantially expanded the liability of the workers compensation system. In California, for example, the number of mental-stress claims more than tripled between 1980 and 1984. Insurers are worried that the relative youth of the claimants indicates that the new generation of workers is, at the very least, inclined to view its emotional problems as compensable. "Techno-stress" has already resulted in some claims—and some awards. A New Jersey word processor operator collected $7500 after blaming her job for her nervous breakdown (*Business Week,* 14 October 1985, page 152).

AN OHIO LAWYER placed an ad asking women if they had used the Dalkon Shield intrauterine device (IUD) for contraception. He used responses from the ad to file 95 suits against the A.M. Robins Company. The Ohio Supreme Court then reprimanded him for violating a state rule prohibiting lawyers from making specific product or company-oriented pitches to solicit new clients. However, the U.S. Supreme Court reversed that decision on free speech grounds. Many consider this decision to be a go-ahead for lawyers to do more target marketing (*Business Week,* 10 June 1985, page 70).

A JAPANESE STUDY reports that more than one-third of pregnant women working at video display terminals (VDTs) have problems during pregnancy or at birth. Of those who worked with VDTs six hours or more a day, two-thirds had problems (*New Scientist,* 23 May 1985, page 7).

MARYLAND'S COURT OF APPEALS ruled unanimously that makers and retailers of "Saturday night specials"—cheap, easily concealed handguns—can be sued by victims of criminal use of their products. The ruling appears to establish a new area of product liability. It states that makers and sellers of such weapons "know or should know that the guns are virtually useless except for criminal activities" (*The Wall Street Journal,* 4 October 1985, page 27).

PROPERTY AND CASUALTY INSURANCE premiums for business are up as much as 1000%, and the availability of insurance has decreased dramatically. Companies are finding themselves with insufficient insurance—or none at all. Yet most businesses want more insurance because litigiousness is increasing and so is the tendency to reinterpret legal doctrines of negligence and fault. In reaction, 33 major U.S. corporations have gathered nearly $300 million to set up their own A.C.E. Insurance Co. in the Cayman Islands. A.C.E., which recently began operations, provides as much as $150 million in liability coverage for each participating corporation; it offers similar coverage to other major companies, which must also buy stock in the insurer (*Fortune,* 10 May 1985, page 67).

Scan's purpose is to provide an early warning of possible changes that, if they occur, could present important threats or opportunities to B-I-P clients. Since our assessments are based on faint signals, B-I-P does not claim that the changes will occur, nor that our assessments are complete or correct. Instead, we hope *Scan* will alert B-I-P clients to possible changes they may not be aware of and stimulate them to explore further those changes whose implications are potentially important to their companies.

On this page *Scan* presents a cluster of faint signals of change identified by SRI International's business environment scanning system. On the following pages, we analyze the cluster and present some implications of the potential change it describes.

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AN ANALYSIS

In the decades since World War II, courts have emerged as one of the most significant engineers of change in U.S. society. Court decisions have brought about extraordinary alterations in political structures, civil rights, criminal justice, and many other social and political arenas. Recent court activity in the definition and determination of liability promises to result in as much change in business as other decisions have created in other sectors of society. (For additional discussion, see "Management and the Law," in *Scan* No. 2029, May/June 1984.)

The past ten years have seen concepts of product liability undergo considerable change. For one, contributory negligence on the part of a plaintiff no longer keeps him or her from winning the suit. In addition, product liability has been extended to cover parties other than those directly involved.

Professional liability has also spread. Malpractice has gone far afield from medicine. Lawyers, architects, engineers, actuaries, consultants—even the clergy—all are increasingly being held accountable in the courts for undesirable consequences resulting from the practice of their respective professions. It is particularly significant that professionals are being successfully sued even when their competence is not in question. Perhaps even more troublesome, however, are decisions wherein determinations of liability are setting new precedents or radically changing old ones—and thereby fundamentally altering the nature of relationships and the structure of organizations.

One such area is personnel. For example, in 1985, decisions in states from California to New Jersey held that statements in a company's employment manual or job offer letter that may reflect on termination policies were the equivalent of contractual provisions and thus were binding on the company. Other decisions have set new restrictions on the rights of management to fire employees. Indeed, the common-law "fire at will" doctrine seems to have gone by the boards altogether. All such changes are forcing companies to think very carefully not only about how and when to fire, but also about how and who to hire. A further complication is the application of the Racketeer Influenced and Corrupt Organizations Act (RICO) to personnel disputes. Under RICO, for example, a pattern is two similar occurrences of wrongful discharge involving the mails over ten years, so a second ruling against an employer can result in treble damages.

The courts are also attempting to clarify the line of demarcation between individual and organizational responsibility, although the result thus far appears to be more questions than answers. In the area of health, particularly, the implications are hard to read. The current concern about stress, for example, has not yet had much clarification. A recent study on stress for the National Institute of Occupational Safety and Health (NIOSH) concluded that stress costs business as much as $150 billion annually. Workers compensation awards for stress-related problems are increasing geometrically. Companies by the hundreds are rushing to institute stress reduction programs. Unanswered yet is the question of how to allocate responsibility for stress, although the courts are clearly leaning toward putting the onus on the employer and discounting the variations among individuals in susceptibility to stress and self-inducement of stress.

Underlying much of the current activity in labor relations liability is the application to the office of an industrial mind-set. Safety and health, which were dominant labor issues in the factory, are now assuming similar importance in the office. The shift to a service economy has apparently left some issues unchanged.

Perhaps the most profound change has yet to receive much attention. Some court decisions are changing the nature of the corporation itself in fundamental ways. The 1985 decision convicting executives of a Michigan corporation of murder in the death of an employee working with a toxic substance was a landmark. Originally, the corporation was a mechanism for limiting personal risk—and not only financial risk. Courts now seem to say that the corporation is not a shield. Individual responsibility of managers and directors is increasing—and, ironically, it is increasing at a time when the responsibility of individual employees is decreasing. Courts are holding corporations more liable in areas where they used to consider the employee responsible (for example, individual health). ■

POSSIBLE IMPLICATIONS

IN THE WORKPLACE

According to the American Institute of Stress, stress reduction programs are already among the top employee assistance activities in most major corporations. This development has occurred practically overnight, and whether the possible consequences have had sufficient study is uncertain. Does the introduction of a stress reduction program imply acknowledgment of employer responsibility for stress, for example? What is the relationship, if any, between stress and productivity? Is stress reduction an integrated part of a coherent human resources strategy so

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POSSIBLE IMPLICATIONS (Continued)

that mistakes—such as following the announcement of a stress reduction program with an announcement of layoffs—are avoidable?

Some employers are looking to strategies that reduce the possibilities of liability. These attempts go beyond merely rewriting recruiting literature. For example, companies are using more contract, leased, and part-time workers. Other companies are taking the opposite tack: introducing expanded benefit programs—exercise and diet, substance abuse counseling, day care, biofeedback, and so on—as an effort to create a caring environment. Some are instituting what approaches guaranteed lifetime employment. And some are even reexamining opposition to unionization because the alternatives (especially lawsuits) have proved worse.

Health and safety in the office are almost certainly expanding issues. Even though a recent U.S. Congress Office of Technology study concluded that we know little about reproductive risks in the workplace, evidence suggests that debate about this topic will receive greater focus in the near future. The large group of educated, articulate, employed baby-boom women now having or contemplating having babies brings the weight of numbers to bear. Birth defects allegedly resulting from indoor pollution and the growing use of electronic equipment seem most likely to generate a substantial amount of litigation.

Given the above, managers may need to evaluate the extent to which their employees' health can be linked to their management style or the environment in which their employees work. For example, a management attitude that says stress is part of any job and that employees are paid for accepting stress may appeal to hard-line, bottom-line management, but it may not to a jury considering an employee's stress-related suit.

To monitor developments affecting health in the workplace, human resource managers may need to increase their surveillance of literature reporting such advances or to strengthen contact with researchers investigating stress, video display terminals, and other dimensions of workplace health. Human resource managers may need to improve channels of communication to senior management and those responsible for the company's legal affairs so that new developments affecting health in the workplace can be considered for their impact on human resource policies, management style, and potential liability.

Selection and training of personnel, including managers, will increase in importance as sensitivity to liability increases within the company and in society in general. Given the "deep pocket" approach to claims settlement, companies may need to be concerned about the selection and training of personnel in companies that they influence strongly. For example, given growing public awareness and concern about charges of child abuse in day-care centers, companies sponsoring such centers may need to take a more active role in the selection and supervision of their personnel.

IN THE MARKETPLACE

The insurance crisis is already having a serious effect—especially on small businesses. Large companies can self-insure to some extent or, as some have recently done, combine to create their own insurance carriers. But small companies are out in the cold. A movement to require insurance companies to provide property and casualty insurance appears to be growing. Proponents argue that insurance has a quasi-utility status and that its unavailability adversely affects business people's opportunity to earn a livelihood. If insurers are required to offer liability coverage, they may demand the right to intervene more directly in the setting and observance of safety conditions and work rules—much as they have done in fire prevention and, of late, in toxic waste handling.

The combined efforts of the courts and public interest groups have set in motion a trend toward broadening liability that seems at the moment irreversible without the intervention of Congress and state legislatures. The hoped-for remedies range from limitations on product liability and class action suits to modification of RICO. If business hopes to overcome the strength of the liability advocates (including, of course, the politically powerful trial lawyers), it will need a carefully developed strategy that will recognize both the requirements of business and the legitimate demands for equity and fair compensation.

The Saturday-night-special case troubles many observers. While it may be hard to defend the manufacturers of such weapons, is it just to decide a manufacturer's intentions on the basis of how some customers use the product? For example, could the manufacturer of a device that alerts drivers to radar used by the highway patrol to spot speeders be held liable for an auto accident? Some people may argue that the device encourages drivers to speed because it reduces their fear of being caught.

AMONG PROFESSIONALS

The trend toward holding people accountable for undesired consequences of their actions—thus toward more charges of malpractice—shows no sign of abatement, despite strenuous efforts by doctors and other adversely affected professionals. It would seem prudent for businesses to do a form of vulnerability analysis of potential trouble areas. For example, what implied promises exist in advertising or promotion materials that might later come

POSSIBLE IMPLICATIONS (Concluded)

back to haunt a company? If a company needs to exercise greater care in marketing, how can it do so without inhibiting creativity? (For a description of vulnerability analysis, see B-I-P *Report* No. 593, *Vulnerability Analysis in Business Planning.*)

Accounting is one of the professions hard hit by malpractice suits and by the difficulties of finding reasonably priced insurance coverage. Accountants' liability, particularly with respect to corporate audits, is likely to increase pressures for disclosure and for more thorough—and costly—audits. This situation would in turn be likely to reinforce the trend toward privatization and to increase concern among financial analysts about making stock purchase recommendations.

Boards of directors will continue to feel liability pressures. As indemnity insurance premiums skyrocket—while providing lower protection ceilings and more exclusions—the courts are toughening their attitudes toward directors' roles, decisions, and prerogatives. Unprotected companies will find directors virtually impossible to recruit, and the prohibitive costs of insurance will guarantee higher prices all along the line.

Social service professions, like day care and nursery administration, will face increasing difficulty in operating at a profit while maintaining a market; this market may be too small to spread the impact of greatly increased expenses, so the cost of these services to consumers may become unreasonable. Thus, at a time when privatization of government and social welfare services is a possible solution to public debt and inefficiency, liability and insurance problems are forcing purveyors of these services—from care givers to waste treatment facilities—out of business. ■

BACKLASH BEGINNING?

The declining availability and high cost of liability insurance are motivating both government and citizens to take action. Two examples:

- Although most large hazardous waste storage and disposal facilities remain open, most small facilities are closing because they can not meet federal requirements for insurance and groundwater monitoring. (Hazardous waste facilities are required to carry insurance that would cover the cost of cleaning up any toxic leaks from the facilities.) The Environmental Protection Agency is sufficiently concerned about effects on the industry that it has asked the congress to delay implementation of the insurance requirement (*The Wall Street Journal,* 9 December 1985, page 8).

- An initiative in California would eliminate the "joint and several" rule that allows a court to require one defendant to pay enlarged damages because a codefendant in the same lawsuit is unable to pay. Instead, the initiative would install a system allowing proportional payments based on degrees of liability determined by the court. The system would not cover economic damages—medical bills, loss of income, and other out-of-pocket expenses incurred directly by the victim; it would apply only to noneconomic damages such as mental and emotional stress. Backing the initiative is a coalition of businesses, insurance companies, taxpayers' organizations, and medical and business lobbies (*Times Tribune,* 14 December 1985, page A-16).

WORTH READING

For a brief overview of the crisis in liability insurance, see "The Search for Available Insurance: Where is it?" in *The Journal of American Insurance,* Fourth Quarter 1985. (This journal is published by the Alliance of American Insurers, 1501 Woodfield Road, Schaumberg, Illinois 60195-4980; telephone 312-490-8543.)

THE NEW PARAMETERS OF LIABILITY

ACKNOWLEDGMENTS

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The B-I-P *Index* lists this *Scan* under the following headings: • Business Environment • Employee Benefits and Services • Financial Institutions • Health Insurance • Insurance Industry • Litigation • Risk Management

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Bill would let federal labs share research

By EVAN ROTH
States News Service

WASHINGTON, D.C. — A House-Senate conference committee on Tuesday approved a compromise bill that would let federal laboratories share their scientific research with private companies.

The bill, originally sponsored in the House by Rep. Bob Michel of Peoria, would permit the creation of a public-private agricultural research and development consortium involving the Northern Regional Research Laboratory in Peoria.

The House passed the Michel bill in December. The Senate passed a similar bill in August. The bills went to a conference committee, which ironed out the conflicts this week.

Michel's press secretary, Johanna Schneider, said the conferees signed the compromise Tuesday, making it eligible for debate at any time before Congress adjourns.

Later in the day, Senate Majority Leader Bob Dole, R-Kan., told Michel that he anticipated no problem in bringing the bill up for a vote before Congress goes home, probably by the end of next week, Schneider said.

Tradition dictates that the Senate would vote on the bill first, she said.

The Technology Transfer Act, as the bill is called formally, would permit federal research agencies, such as the Peoria ag lab, to share their discoveries with private companies to permit commercial exploitation.

The act is required to allow the Peoria lab to get involved in a partnership with the University of Illinois Biotechnology Center and the University of Illinois Medical School.

The House has approved a $2 million appropriation as seed money for the consortium. The appropriation now being considered in the Senate is part of a massive $556 billion spending bill.

WASH. POST 10/28/86

15 U.S. Firms Seek Ventures With Soviets

By James L. Rowe Jr.
Washington Post Staff Writer

The Soviet Union has received proposals from 15 U.S. companies to participate in joint ventures with Soviet firms, a top Soviet trade executive said yesterday.

Last month, the U.S.S.R. announced a series of moves to decentralize its trade relations—including permitting Soviet enterprises to enter into joint ventures with private firms, including those from the West, and authorizing some ministries and enterprises to deal directly with foreign importers and exporters.

The U.S.S.R. does not now allow Soviet companies to engage in ventures with western firms. It also requires that nearly all exports and imports be carried out through the Foreign Trade Ministry—which makes it hard for enterprises to buy imports and difficult for individual Soviet firms to produce for export.

The details have not been completed either for the direct import and export of goods or for the proposal for the joint ownership of producing companies in the Soviet Union.

The Soviet Union is anxious to increase the efficiency of its industries and to broaden the base of its export earnings, now heavily dependent on raw materials, mostly energy. Joint ventures with foreign firms would introduce new technology into Soviet industries and produce higher-quality goods more efficiently.

Many experts question whether

See TRADE, F2, Col. 5

U.S. Firms Reportedly Seek Joint Ventures With Soviets

TRADE, From F1

the highly centralized Soviet bureaucracy is prepared for the high degree of decentralization that reforms in the foreign trade sector would require.

James H. Giffen, president of the U.S.-U.S.S.R. Trade and Economic Council, said in a telephone interview that the Soviets are serious about the changes—at all levels of government, from Chairman Yuri Gorbachev on down. He said the Soviets "will be flexible in writing the rules. They don't want to make the mistakes of other centrally planned economies that made the rules [on joint ventures] so rigid that there was no possibility of profit."

Yuri Shcherbina, chairman of the Amtorg Trading Corp., said in a speech here yesterday that joint ventures will involve relatively small enterprises at first, and that not less than 51 percent of each venture will be owned by the Soviet Union.

The law governing joint ventures has not yet been completed, Shcherbina said in an address to the U.S.-Soviet Trade Forum. But earlier this month, he said, the government set down "general conditions" for joint ventures that give the foreign partners some "privileges," including guarantees that they can repatriate earnings.

He also said that the foreign companies will receive "favorable tax treatment."

Among the industries that will be open to joint ventures are energy, food, chemicals, some consumer goods and mineral extraction, Shcherbina told the audience—which included business exeutives, trade association representatives and government officials.

He said that any joint venture will "have to aim at exporting" at least part of its output to produce enough foreign currency earnings to satisfy the needs of the foreign partner to pay dividends to its parent company.

Giffen, who also is chairman of the Mercator Corp., a New York investment bank, said that he and Archer-Daniels-Midland Chairman Dwayne Andreas proposed a joint soybean processing facility to Gorbachev two years ago. Giffen said that such a facility could be one of the first joint ventures approved.

Giffen said that a "substantial" venture probably would meet with their approval if it was interesting enough and well thought out.

Shcherbina said that trade between the United States and the Soviet Union has been diminishing in recent years. He blamed the decline on anti-Soviet attitudes in the United States that often make the country an unreliable supplier. Last year, trade totaled $1.4 billion and is expected to be smaller this year.

Historically, the Soviet Union has preferred trading with Western Europe rather than the United States. Whether those historical preferences can be overcome will have a major influence on how important the new Soviet attitude toward foreign trade and investment will be to the U.S. economy.

A questioner from the audience said that the United States' unreliability as a supplier looms no larger than the Soviet Union's unreliability as a buyer. He pointed out that, for the second year in a row, the U.S.S.R. will not buy as much grain as it is supposed to under an agreement between the two nations.

U.S. Sales in Japan Decline Despite Talks

By Stuart Auerbach
Washington Post Staff Writer

U.S. sales in Japan declined in the first six months after the Reagan administration declared that year-long trade talks had succeeded in opening Japan's market for high technology goods.

Commerce Department figures for the first half of this year showed that U.S. sales declined compared with the same period in 1985 in the fields of telecommunications and electronics. These are sectors in which the Reagan administration and U.S. industry officials expected sales increases as a result of the trade negotiations.

The trade talks were the centerpiece of administration efforts through most of 1985 to ease the mounting U.S. trade deficit with Japan, which hit a record $48.5 billion last year and will be even higher this year. The intensive negotiations in four areas—called Market-Oriented, Sector-Selective (MOSS) talks—were initiated in January 1985 by President Reagan and Prime Minister Yasuhiro Nakasone to ease growing trade frictions between the two countries.

"We must begin to hear the cash registers ring," Secretary of State George P. Shultz said last year in defining how the success of the talks will be measured.

In January, Shultz hailed the end of the negotiations for tearing down Japanese barriers to sales of U.S. manufactured products and cited "very substantial purchases" by Japan as evidence of the talks' success.

The only major area covered by the MOSS talks showing an increase in sales of manufactured goods was pharmaceutical products and medical equipment, where sales increased by $36.5 million in the first half of this year. Sales of U.S. forest products showed gains of $106 million, but most of that was in unfinished logs, not Japanese purchases of manufactured goods that were supposed to increase as a result of the MOSS talks.

Administration officials said, "It's too early to judge" whether the talks are successful or not on the basis of increased sales. They added that the subject will be discussed by Japanese and U.S. officials later this month at a subcabinet-level meeting on economic affairs.

But Lionel Olmer, the former undersecretary of Commerce who played a major role in negotiating the opening of the Japanese telecommunications and eleetronics markets, said he was "disappointed in the starkness of the numbers."

Another former Commerce official who played a large part in the talks, Clyde Prestowitz, said, "the mountain of labor brought forth a mouse."

He added, though, that a new ease of doing business in Japan and increased sales of telecommunications services, which do not show up in the trade figures, make the picture less bleak than the numbers alone would paint.

Representatives of the U.S. electronics and telecommunications industries told their Japanese counterparts last month that they were disappointed in U.S. sales in the face of promises by 57 major Jap-

See TRADE, C2, Col. 1

The Washington Post
Saturday, October 18, 1986

TRADE, From C1

anese companies to increase their purchases of American-made goods.

"This year's rationale" from Japanese business executives was " 'our economy is way down' " and sales are slow for Japanese companies, said Ralph J. Thompson, senior vice president of the American Electronics Association.

On the plus side, Thompson said U.S. companies now have greater access to potential Japanese buyers. "It's a question of changing attitudes" so they will buy U.S. products, added Brian P. Wynne, AEA's manager of international trade affairs.

Democratic senators, who have been pressing the administration to do more to turn around four years of record trade deficits that now have become a brake to economic growth, expressed surprise at the decline of U.S. sales to Japan in electronics and telecommunications.

"It's just going to add fuel to those protectionist fires around here," said Sen. Max Baucus (D-Mont.).

Sen. Lloyd Bentsen (D-Tex.), who would become chairman of the Finance Committee if the Democrats gain control of the Senate next year, attacked the idea of the MOSS talks because they are based "on the mistaken belief" that Japan will give up its traditional way of doing business.

"In the Japanese view, they have been very successful and see no reason to change. But that's a lesson we never seem to learn," he said.

Chicago University, National Lab Seek Profit From Ideas

* * *

School, Argonne Set Venture To Help Commercialize Scientific Discoveries

By FRANK E. JAMES
Staff Reporter of THE WALL STREET JOURNAL

CHICAGO—The University of Chicago said it created a joint venture with Argonne National Laboratory to help commercialize scientific discoveries made at the two institutions.

The formation of Argonne National Laboratory/University of Chicago Development Corp., or ARCH, represents the first time a national laboratory and its research-university partner have teamed up to commercialize their discoveries. The University of Chicago operates Argonne as a contractor for the U.S. Department of Energy.

The move comes as the federal government is trying to stimulate the transfer of technology from federal laboratories to private industry. The effort is a response to the longstanding problem of most government-lab discoveries not being commercialized because of bureaucratic red-tape or corporate apathy. Companies have been unwilling to pursue such taxpayer-financed discoveries because they haven't easily been able to gain proprietary rights to the patents.

In 1984, Congress made it possible for companies to gain title to discoveries stemming from research at such labs as Argonne, although the law wasn't effective until July. And in legislation Congress passed last week, federal labs received authority to set up cooperative research-and-development pacts with businesses. The legislation also calls for government researchers whose inventions are licensed to get 15% of license revenue or a fixed payment.

The university also said that Steven Lazarus, group vice president of health-care services for Baxter Travenol Laboratories Inc., based in Deerfield, Ill., will head the venture.

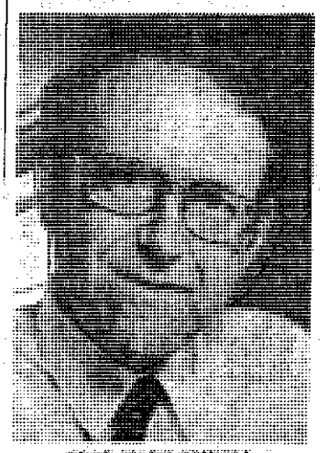
The university said professors and students at its graduate school of business will provide the venture with marketing proposals and business plans for the new technologies. Mr. Lazarus also has been appointed associate dean of the business school.

Argonne, the first national laboratory and one of the largest such laboratories, does research in a variety of fields, including nuclear and alternative energy, biomedicine, the physical sciences and the environment. Its annual budget is about $230 million and it has 4,000 employees.

The joint venture will be financed by the university and Argonne for its first five years and will be self-sustaining after that, the university said. Alan Schriesheim, Argonne's director, said in addition to the licensing of discoveries to businesses, the venture will allow the partners to get equity stakes in companies that may be started to develop the partnership's ideas.

WASHINGTON POST WEDNESDAY, OCTOBER 22, 1986

Professors Invent Collegiate Quandary



PROF. MARK SPIKELL
...invented high-tech clipboard

By D'Vera Cohn
Washington Post Staff Writer

No one knew quite what to do when Prof. Mark Spikell approached George Mason University officials a few years ago with an intriguing idea that he hoped could bring both of them money and recognition.

Spikell wanted paid time off from the state-supported Northern Virginia school to develop an invention: a high-tech clipboard to translate handwriting into computer data. It would allow sales orders scribbled by a traveling sales agent, for example, to be entered directly into the company's computer.

The problem was that the university had no policy governing its professors' products. In the end, Spikell and George Mason made a friendly deal; Spikell got the time off, and the university will get a share of the revenue if the invention, called DataPad, makes money when it is marketed next summer.

The outcome is not always so peaceful when universities and their professors sit down to negotiate ownership and revenue rights to "intellectual property," as a growing number are doing.

Money is one reason. Royalties from professors' inventions offer an attractive source of cash to universities suffering from budget cuts. Most inventions do not yield vast wealth, but in totality can be big business.

Stanford University, for example, made $3.9 million in gross royalties last year from products including a computer program to assist with airplane design. The University of Virginia makes $1 million a year from 126 licensed products, most of them medical devices or drugs. So far George Mason has made only a few thousand dollars.

See PATENTS, A15, Col. 1

Professors' Inventions Put Universities in Policy Bind

PATENTS, From A1

"Clearly the university deserves some return because they've given me a lot of encouragement and support," Spikell said of his deal with George Mason.

One problem case that still is talked about in academic circles involves Stephen Wolfram, a brilliant young physicist who left the California Institute of Technology four years ago in a bitter high-stakes dispute over ownership of a computer software program he designed. Wolfram, winner of a MacArthur Foundation "genius award," defected to Princeton's Institute of Advanced Studies, where he negotiated an agreement that lets him own the rights to his future inventions.

At the time, CalTech had no written policy governing ownership of computer software, which remains the thorniest area in intellectual property disputes. It later wrote regulations that give the university extensive rights and most of the royalties.

Spurred by inventions such as Spikell's and by a new state law, George Mason University's Board of Visitors recently approved tentative rules governing employes' inventions that can be patented and copyrighted. The law, passed this year by the Virginia General Assembly, requires all state-supported schools to draft intellectual property policies and is part of a growing academic interest in entrepreneurial ventures.

"We're always looking for the one invention that will make us rich," said Ralph Pinto, patent administrator at the University of Virginia, which has a well-developed program begun a decade ago.

Policies drafted by universities range all over the map. But many, including George Mason's, allow faculty to keep the rights and royalties from their copyrighted books or works of art. Patent policies, on the other hand, often require inventors to hand over ownership and a share of the revenues to the university.

A 1984 survey by the Society of University Patent Administrators found that half the 127 institutions it polled had adopted or revised policies in the last five years, and only four had none. The group's national membership has more than doubled in the last three years, from fewer than 200 to its current 500.

Some say a properly written policy can keep inventive professors from deserting academia for well-paying jobs in private industry, as happened with some of the nation's most gifted biotechnology researchers in the late 1970s.

"Historically we have given our best and brightest professors a black and white choice: Stay in the religious institution of chastity and obedience, or leave the institution and be an entrepreneur," Spikell said. "I've seen it over and over . . . entrepreneurs who have had to leave the university to start their own companies."

Computer software, a suddenly profitable field in which the rules of ownership are unclear, has accelerated interest in policies.

It was a lucrative computer software program for libraries developed several years ago by researchers at Virginia Tech that triggered the General Assembly action this year. Revenue from the discovery was not going to the state, but to a private university-affiliated foundation.

"Clearly the university deserves some return . . . ."

—Prof. Mark Spikell
George Mason University

House Speaker A.L. Philpott (D-Henry) was enraged, and demanded an investigation. The Joint Legislative Audit and Review Commission concluded that some of the work was done on state time, and suggested the state draft ownership rules so a similar situation would not happen again.

The library program's inventors later paid $50,000 to the general fund. To date, the invention has brought in more than $700,000.

The legislature ordered the Center for Innovative Technology—a Northern Virginia-based state project to promote technology by linking industry and academia—to act as licensing and marketing agent for state-supported schools. Universities in other states either have their own marketing organizations or turn to professional firms.

The CIT has negotiated agreements with five schools—Old Dominion University, Virginia Tech, Virginia Commonwealth University, James Madison University and the University of Virginia. It will sponsor a workshop next year on the subject of entrepreneurial professors.

Among the products in the CIT's pipeline—none is yet on the market—is an embryo technology developed by researchers at Old Dominion University that will enable farmers to transplant eggs from high-yielding dairy cows into poor producers, thereby upgrading the herd.

Another, developed by two professors at Virginia Tech, is a copyrighted software program to store digitalized blueprint information, compressing into a small amount of space the information that now overflows warehouses, according to Auzville Jackson Jr., the CIT's director of intellectual property.

"The role of the university is first education," Jackson said. "But it's become much more important to our society. The university is one of the most signficant forces we have in economic development."

"If a university can make a little money to defray the costs of education, that's well justified," said Randolph Church, a member of George Mason's board and its former rector.

University officials insist, however, that money is not the only reason. Supporters of copyright and patent policies say they encourage professors to market their inventions by offering help with the complexities of licensing and sales agreements. Many professors, they say, derive primary satisfaction and their academic reputations by publishing in scholarly journals, not from making money.

"Most universities are still in the mode that they've achieved what they need to achieve by getting it [scholarly discoveries] published," said Jackson, who believes a professor's patents should be considered in deciding whether to award tenure. "We want to see it utilized, rather than buried in an obscure intellectual journal."

University inventions still account for only a tiny fraction of new products. Jackson said universities file only 1 to 2 percent of patent applications now. He thinks the figure should rise to 5 percent.

Some warn that inventions never will be a golden goose for universities, despite hopes of some overeager administrators.

"What people don't realize . . . is that there's so much chaff and only a few grains of wheat," said Steve Bacon of Research Corp., an Arizona firm that helps universities patent their inventions. He estimates that out of every $1 million poured into university research, only one worthwhile invention results.

The GATT Mine Field

By JEFFREY E. GARTEN

When trade ministers from Washington east to Jakarta, and from Tokyo west to Buenos Aires, gather in Uruguay next week to launch a new round of negotiations, expect the standard pap about free trade and fair play. Harmless as this may seem, these talks may not be in Washington's best interests.

Sure, we're all for more trade. But these negotiations, pushed almost singlehandedly by the Reagan team for the past five years, are based on mistaken optimism that a new set of bargaining that encompasses everything from wheat to insurance and involves virtually all nations will lead to the freeing up of trade. Get everyone around a table to discuss all problems at once, so the reasoning goes, and the result will be lower barriers to the movement across borders of food, manufactures, technology, even banking.

Misplaced Faith

The fact is that the momentum is over for progressive trade liberalization through omnibus, multilateral marathons like the coming session under the General Agreement on Tariffs and Trade (GATT). The push ended when tariffs were negotiated down to insignificant levels in most countries, including the U.S. and Japan, leaving non-tariff barriers—such as quotas and regulations on procurement, customs procedures, and protection of national security—as obstacles to commerce.

The administration has advocated global trade talks because this is how the executive branch has done things in the past and because it believes they will reduce congressional pressure for more protectionism in the face of a looming $170 billion trade deficit. Unfortunately, such faith is misplaced.

Start with false historical analogies. Washington remembers such trade negotiations as the Dillon Round (1960-1961), the Kennedy Round (1963-1967), and the Tokyo Round (1974-1979)—which together gave a terrific boost to world trade by lowering tariffs from 40% to less than 5%. American officials recall that these events were successful because the U.S. was able to trade off concessions on its side for more-or-less equivalent breaks from other nations—lower duties on steel imports into the U.S. from Kobe, for example, for easier entry for Kansas grains into Japan.

The current scene is different. Unlike import duties, non-tariff barriers cannot be lowered with percentage cuts. Instead, a new system of regulation—a legal "code"—must be set up specific to each of the many different impediments to trade, agreed to by a host of countries, and monitored and enforced internationally. These highly detailed and legalistic arrangements provide very little opportunity for trade-offs. Is it realistic, for example, that Brazil would lower its national-security strictures against computer imports from all countries in exchange for everyone else's loosening up on health regulations concerning certain agricultural products? It is more likely, in fact, with so many countries and issues mixed together, that stalemate will prevail.

Another change of scene relates to America's negotiating leverage. In the past, U.S. economic dominance was overwhelming. Japan did not really become an economic superpower until the end of the Carter administration. The Brazils, Koreas and Taiwans have only recently become major world traders.

Now Washington is playing with a weak hand. It wants something very specific and precious to other nations: an opening of their technology markets, easier entry for our banks and insurance companies, tougher copyright laws, major reforms in Europe's agriculture. In the past the U.S. could promise others the quid pro quo of increased access to our market. But today we've given everything away unilaterally, thanks to our consumption-stimulating budget deficits, our no-strings-attached approach to deregulation of telecommunications and financial services, and Washington's blase attitude toward a soaring dollar between 1980 and 1984.

America's weakness is compounded by debilitating contradications between the administration free-trade rhetoric and its protective actions on steel, footwear, machine tools, motorcycles, textiles, shingles and sugar. In the past few months alone, the administration proposed and concluded a semiconductor pact with Japan that is a price-supporting cartel involving extensive government regulation. Washington has slapped subsidies on wheat to the U.S.S.R., mocking its own criticism of similar European practices and clobbering allies like Australia that do not subsidize. At bottom, moreover, U.S. trade policy consists of threats to unleash a protectionist Congress and further weaken the dollar, both of which will harm ourselves as well as others.

It is vital for the U.S. to focus on issues where substantial results are achievable soon. This calls not for a global jamboree, but for negotiations on a more manageable scale.

The great danger is that a new round will have a constricting and not liberalizing impact.

As in the past, the administration will have to pay a price to get negotiating authority from Congress and then to get legislative ratification for the subsequent agreements. It's a pattern known in arms-control pacts where the cost of appeasing the Pentagon with new tanks, ships and planes exceeds the weapons reduction in the disarmament agreement itself.

There is also the problem of false expectations. Both the administration and Congress believe the problem with U.S. trade is that others cheat on the rules, and Washington is determined that the new negotiations will address this problem head on. But in 1984, only 5% of imports to the U.S. were challenged before the International Trade Commission for unfair practices and only half of that amount was officially declared unfair. The frustration of dashed hopes could lead to a backlash of even more protectionism.

Moreover, the sheer number of countries involved in the global negotiations is apt to result in a lowest-common-denominator approach to trade policy and thereby reinforce the trend toward "managed trade," a euphemism for more regulation along the lines of the Multifiber Agreement, the most recent version of which was signed last month. Codes dealing with non-tariff barriers involving nations of so many different stages of development are particularly susceptible to more bureaucratic intervention, more red tape and more fine print, since they have to address so many different legal and administrative systems.

For the U.S., it is vital to focus on issues where substantial results are achievable, and soon. This calls not for a global jamboree, but for negotiations on a more manageable scale, sometimes bilateral, sometimes involving several nations. And to make real headway, trade will have to be discussed alongside other economic issues.

In fact, the GATT talks could divert attention from a really important trade agenda.

It is critical, for example, that the U.S. keep relentless pressure on Tokyo to open its markets, not just with lower quotas but also with a faster paced gross national product. Global negotiations make it easier for Japan to squirm out of the limelight and to defer decisions until "broad consensus" is reached.

The U.S. should intensively pursue a free trade and currency coordination pact with Canada; exports and imports with our largest trading partner exceed $100 billion annually. It should likewise propose a package of debt-relief and trade promotion with Mexico, our most important Third World market. Yet focus on these issues will be blurred in the hubbub of Punta del Este.

We ought to negotiate hard to free up trade in wheat, telecommunications and financial services, for example, but the task is best accomplished in smaller forums and not with all the world's trade bureaucrats at the same table.

Tied Hands

The biggest setback would be if the new trade round distracted attention from our own home-grown competitive handicaps—an antitrust policy that ties our hands against corporate giants from abroad, an approach to research-and-development promotion that centers on military and not industrial technology, and a failure to devise a market-oriented system to lessen the impact on workers and communities clobbered by imports. Most of all, Washington needs to devise a policy toward the dollar that doesn't extol its sky-high value one day, then dramatically diminish it the next.

Paula Stern, recent head of the International Trade Commission, put it well: "Our chief concern need not be the tilt of the playing field. We must concentrate, instead, on building up the American team."

Mr. Garten, a managing director of Shearson Lehman Brothers Inc., just completed a two-year assignment in Tokyo.

AN ANALYSIS

In the decades since World War II, courts have emerged as one of the most significant engineers of change in U.S. society. Court decisions have brought about extraordinary alterations in political structures, civil rights, criminal justice, and many other social and political arenas. Recent court activity in the definition and determination of liability promises to result in as much change in business as other decisions have created in other sectors of society. (For additional discussion, see "Management and the Law," in *Scan* No. 2029, May/June 1984.)

The past ten years have seen concepts of product liability undergo considerable change. For one, contributory negligence on the part of a plaintiff no longer keeps him or her from winning the suit. In addition, product liability has been extended to cover parties other than those directly involved.

Professional liability has also spread. Malpractice has gone far afield from medicine. Lawyers, architects, engineers, actuaries, consultants—even the clergy—all are increasingly being held accountable in the courts for undesirable consequences resulting from the practice of their respective professions. It is particularly significant that professionals are being successfully sued even when their competence is not in question. Perhaps even more troublesome, however, are decisions wherein determinations of liability are setting new precedents or radically changing old ones—and thereby fundamentally altering the nature of relationships and the structure of organizations.

One such area is personnel. For example, in 1985, decisions in states from California to New Jersey held that statements in a company's employment manual or job offer letter that may reflect on termination policies were the equivalent of contractual provisions and thus were binding on the company. Other decisions have set new restrictions on the rights of management to fire employees. Indeed, the common-law "fire at will" doctrine seems to have gone by the boards altogether. All such changes are forcing companies to think very carefully not only about how and when to fire, but also about how and who to hire. A further complication is the application of the Racketeer Influenced and Corrupt Organizations Act (RICO) to personnel disputes. Under RICO, for example, a pattern is two similar occurrences of wrongful discharge involving the mails over ten years, so a second ruling against an employer can result in treble damages.

The courts are also attempting to clarify the line of demarcation between individual and organizational responsibility, although the result thus far appears to be more questions than answers. In the area of health, particularly, the implications are hard to read. The current concern about stress, for example, has not yet had much clarification. A recent study on stress for the National Institute of Occupational Safety and Health (NIOSH) concluded that stress costs business as much as $150 billion annually. Workers compensation awards for stress-related problems are increasing geometrically. Companies by the hundreds are rushing to institute stress reduction programs. Unanswered yet is the question of how to allocate responsibility for stress, although the courts are clearly leaning toward putting the onus on the employer and discounting the variations among individuals in susceptibility to stress and self-inducement of stress.

Underlying much of the current activity in labor relations liability is the application to the office of an industrial mind-set. Safety and health, which were dominant labor issues in the factory, are now assuming similar importance in the office. The shift to a service economy has apparently left some issues unchanged.

Perhaps the most profound change has yet to receive much attention. Some court decisions are changing the nature of the corporation itself in fundamental ways. The 1985 decision convicting executives of a Michigan corporation of murder in the death of an employee working with a toxic substance was a landmark. Originally, the corporation was a mechanism for limiting personal risk—and not only financial risk. Courts now seem to say that the corporation is not a shield. Individual responsibility of managers and directors is increasing—and, ironically, it is increasing at a time when the responsibility of individual employees is decreasing. Courts are holding corporations more liable in areas where they used to consider the employee responsible (for example, individual health). ■

POSSIBLE IMPLICATIONS

IN THE WORKPLACE

According to the American Institute of Stress, stress reduction programs are already among the top employee assistance activities in most major corporations. This development has occurred practically overnight, and whether the possible consequences have had sufficient study is uncertain. Does the introduction of a stress reduction program imply acknowledgment of employer responsibility for stress, for example? What is the relationship, if any, between stress and productivity? Is stress reduction an integrated part of a coherent human resources strategy so

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POSSIBLE IMPLICATIONS (Continued)

that mistakes—such as following the announcement of a stress reduction program with an announcement of layoffs—are avoidable?

Some employers are looking to strategies that reduce the possibilities of liability. These attempts go beyond merely rewriting recruiting literature. For example, companies are using more contract, leased, and part-time workers. Other companies are taking the opposite tack: introducing expanded benefit programs—exercise and diet, substance abuse counseling, day care, biofeedback, and so on—as an effort to create a caring environment. Some are instituting what approaches guaranteed lifetime employment. And some are even reexamining opposition to unionization because the alternatives (especially lawsuits) have proved worse.

Health and safety in the office are almost certainly expanding issues. Even though a recent U.S. Congress Office of Technology study concluded that we know little about reproductive risks in the workplace, evidence suggests that debate about this topic will receive greater focus in the near future. The large group of educated, articulate, employed baby-boom women now having or contemplating having babies brings the weight of numbers to bear. Birth defects allegedly resulting from indoor pollution and the growing use of electronic equipment seem most likely to generate a substantial amount of litigation.

Given the above, managers may need to evaluate the extent to which their employees' health can be linked to their management style or the environment in which their employees work. For example, a management attitude that says stress is part of any job and that employees are paid for accepting stress may appeal to hard-line, bottom-line management, but it may not to a jury considering an employee's stress-related suit.

To monitor developments affecting health in the workplace, human resource managers may need to increase their surveillance of literature reporting such advances or to strengthen contact with researchers investigating stress, video display terminals, and other dimensions of workplace health. Human resource managers may need to improve channels of communication to senior management and those responsible for the company's legal affairs so that new developments affecting health in the workplace can be considered for their impact on human resource policies, management style, and potential liability.

Selection and training of personnel, including managers, will increase in importance as sensitivity to liability increases within the company and in society in general. Given the "deep pocket" approach to claims settlement, companies may need to be concerned about the selection and training of personnel in companies that they influence strongly. For example, given growing public awareness and concern about charges of child abuse in day-care centers, companies sponsoring such centers may need to take a more active role in the selection and supervision of their personnel.

IN THE MARKETPLACE

The insurance crisis is already having a serious effect—especially on small businesses. Large companies can self-insure to some extent or, as some have recently done, combine to create their own insurance carriers. But small companies are out in the cold. A movement to require insurance companies to provide property and casualty insurance appears to be growing. Proponents argue that insurance has a quasi-utility status and that its unavailability adversely affects business people's opportunity to earn a livelihood. If insurers are required to offer liability coverage, they may demand the right to intervene more directly in the setting and observance of safety conditions and work rules—much as they have done in fire prevention and, of late, in toxic waste handling.

The combined efforts of the courts and public interest groups have set in motion a trend toward broadening liability that seems at the moment irreversible without the intervention of Congress and state legislatures. The hoped-for remedies range from limitations on product liability and class action suits to modification of RICO. If business hopes to overcome the strength of the liability advocates (including, of course, the politically powerful trial lawyers), it will need a carefully developed strategy that will recognize both the requirements of business and the legitimate demands for equity and fair compensation.

The Saturday-night-special case troubles many observers. While it may be hard to defend the manufacturers of such weapons, is it just to decide a manufacturer's intentions on the basis of how some customers use the product? For example, could the manufacturer of a device that alerts drivers to radar used by the highway patrol to spot speeders be held liable for an auto accident? Some people may argue that the device encourages drivers to speed because it reduces their fear of being caught.

AMONG PROFESSIONALS

The trend toward holding people accountable for undesired consequences of their actions—thus toward more charges of malpractice—shows no sign of abatement, despite strenuous efforts by doctors and other adversely affected professionals. It would seem prudent for businesses to do a form of vulnerability analysis of potential trouble areas. For example, what implied promises exist in advertising or promotion materials that might later come

POSSIBLE IMPLICATIONS (Concluded)

back to haunt a company? If a company needs to exercise greater care in marketing, how can it do so without inhibiting creativity? (For a description of vulnerability analysis, see B-I-P *Report* No. 593, *Vulnerability Analysis in Business Planning*.)

Accounting is one of the professions hard hit by malpractice suits and by the difficulties of finding reasonably priced insurance coverage. Accountants' liability, particularly with respect to corporate audits, is likely to increase pressures for disclosure and for more thorough—and costly—audits. This situation would in turn be likely to reinforce the trend toward privatization and to increase concern among financial analysts about making stock purchase recommendations.

Boards of directors will continue to feel liability pressures. As indemnity insurance premiums skyrocket—while providing lower protection ceilings and more exclusions—the courts are toughening their attitudes toward directors' roles, decisions, and prerogatives. Unprotected companies will find directors virtually impossible to recruit, and the prohibitive costs of insurance will guarantee higher prices all along the line.

Social service professions, like day care and nursery administration, will face increasing difficulty in operating at a profit while maintaining a market; this market may be too small to spread the impact of greatly increased expenses, so the cost of these services to consumers may become unreasonable. Thus, at a time when privatization of government and social welfare services is a possible solution to public debt and inefficiency, liability and insurance problems are forcing purveyors of these services—from care givers to waste treatment facilities—out of business. ■

BACKLASH BEGINNING?

The declining availability and high cost of liability insurance are motivating both government and citizens to take action. Two examples:

- Although most large hazardous waste storage and disposal facilities remain open, most small facilities are closing because they can not meet federal requirements for insurance and groundwater monitoring. (Hazardous waste facilities are required to carry insurance that would cover the cost of cleaning up any toxic leaks from the facilities.) The Environmental Protection Agency is sufficiently concerned about effects on the industry that it has asked the congress to delay implementation of the insurance requirement (*The Wall Street Journal,* 9 December 1985, page 8).

- An initiative in California would eliminate the "joint and several" rule that allows a court to require one defendant to pay enlarged damages because a codefendant in the same lawsuit is unable to pay. Instead, the initiative would install a system allowing proportional payments based on degrees of liability determined by the court. The system would not cover economic damages—medical bills, loss of income, and other out-of-pocket expenses incurred directly by the victim; it would apply only to noneconomic damages such as mental and emotional stress. Backing the initiative is a coalition of businesses, insurance companies, taxpayers' organizations, and medical and business lobbies (*Times Tribune,* 14 December 1985, page A-16).

WORTH READING

For a brief overview of the crisis in liability insurance, see "The Search for Available Insurance: Where is it?" in *The Journal of American Insurance,* Fourth Quarter 1985. (This journal is published by the Alliance of American Insurers, 1501 Woodfield Road, Schaumberg, Illinois 60195-4980; telephone 312-490-8543.)

THE NEW PARAMETERS OF LIABILITY

ACKNOWLEDGMENTS

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The Washington Post SEPTEMBER 14, 1987

Washington Business

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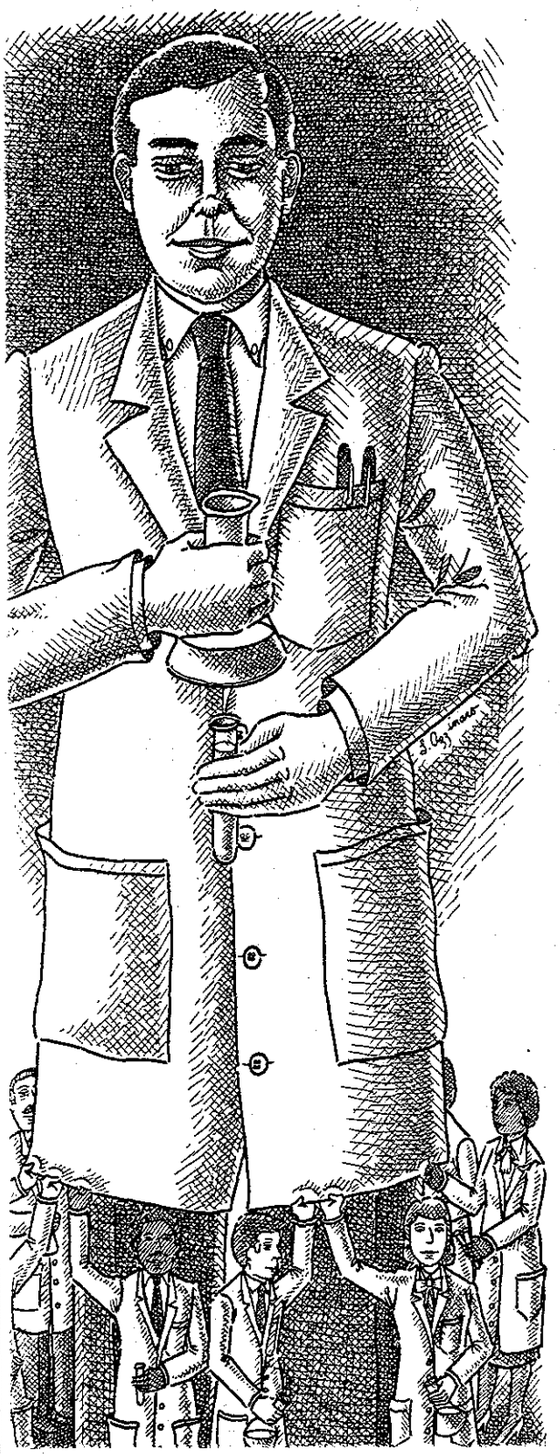


NIH's Doors Opening To Private Companies

New Rules Will Let Researchers Share Knowledge

By Malcolm Gladwell
Washington Post Staff Writer

The doors to National Institutes of Health are about to swing open to the nation's businesses.

A top-level committee at the federal government's giant in-house medical laboratory in Bethesda is drafting guidelines that will give companies unprecedented access to the institute's enormous research resources.

The NIH initiative follows legislation passed last year by Congress designed to improve the dismal track record of federal laboratories in commercializing their research. Since the 1950s only about 5 percent of the federal government's 28,000 patented inventions have been licensed for public use. The Technology Transfer Act, which affects the nation's 775 federal research laboratories, gives the country's 80,000 federally employed scientists and engineers the means and a "national mission" to share their work with industry.

While some business executives have doubts about that mission, the potential impact on jobs and businesses is enormous.

"Technology exists in our federal labs that is not readily available to private industry," Jack McConnell, corporate director for advanced technology with the Johnson & Johnson Co., told Senate hearings on the bill. "This technology provides the basis for creating entirely new products . . . [and] could be a source of thousands, even tens of thousands, of new private-sector jobs in the USA."

Under the proposals to be adopted by NIH, companies will be guaranteed exclusive licensing rights to the fruits of any research undertaken with a government laboratory. In addition, NIH scientists and laboratories will be given hefty incentives to seek commercial applications for their work, such as a share of royalties that would generally be denied a researcher in corporate laboratories.

"It's going to encourage scientists to seek collaborators and industry to seek out scientists," said Ithzak Jacoby, director of the office of medical applications and research at NIH. "Over the next few years we're going to see the building of a great number of fruitful cooperations."

Some of the changes about to be introduced at NIH have been in place informally for the past several years, and the institute has long worked with private industry either directly through scientific collaborations or indirectly through the funding of commercial research. Just this summer, NIH was instrumental in the development by Microgenesys Inc., a biotech firm based in Connecticut, of the first AIDS vaccine for human testing.

But never has the problem of getting technology out of government labs and into the marketplace been given such emphasis.

Just how the new joint agreements will work was demonstrated in July when the Department of Agriculture's Beltsville lab linked with a North Carolina biotechnology firm called Embrex. Under the terms of the

See LABS, page 14

INSIDE

NIH Scientists Get Means To Share Their Research

LABS, from page 1

agreement, the first of its kind under the Technology Transfer Act, the Agriculture Department and Embrex will produce a vaccine to combat coccidiosis, a chicken disease that can seriously hurt the $7 billion-a-year poultry industry.

Alan Herosian, president of Embrex, said he had been interested in exploiting some of the research done by the Beltsville lab, but "had no idea how to do it. We were looking for a way to make the synergy work, and luckily Congress came along and passed this law."

Without government help, Herosian said, developing the vaccine would be difficult if not impossible. But without the new licensing arrangement, his firm could not have been guaranteed exclusive marketing rights to the fruits of a joint venture.

"We used to have an arm's-length relationship with business," said James Hall, who runs the technology-transfer program at the Beltsville facility. "Now there's much more of a symbiosis. We expect to see steady growth in this area."

Expectations for NIH's program, which should be in place before the end of the year, are running even higher. Already the Washington-Baltimore corridor is home to one of the nation's largest concentrations of biotechnology companies. The hope is that the new licensing agreements and joint-venture arrangements will allow NIH to forge stronger ties with surrounding biotech firms. In fact, the reforms under consideration are modeled closely on those made by the patents and trademark amendments of 1980 that are widely credited with prompting the enormous growth in private-sector funding of university research during the past seven years.

"We are trying to do the same thing for federal laboratories that we did for universities 10 years ago," said Joseph Allen, a technology policy liaison with the Department of Commerce. "If you look at where the big high-tech growth has been recently, it's been around places like Stanford and Harvard in silicon valley and Route 128. We think the same thing's going to happen around NIH."

At present, the institute's ties to local firms are considered to be highly informal. "A lot of people left NIH to go into private industry and decided to stay in the area," Jacoby said. But beyond that kind of cross-pollination of talent, and the inevitable local concentration of biomedical service firms that do contract work for NIH labs, the institute hasn't courted private firms in anything like the manner that major research universities have.

Indeed, to the extent that NIH has worked with industry, institute officials confirm that local firms have played no more prominent a role than anyone else. Genex, one of the oldest and best known of Maryland biotech companies, didn't take any government money from NIH for its first six years. Biotech Research Labs, the Rockville firm that was licensed by the FDA in May to produce the "Western Blot" test kit for acquired immune deficiency syndrome, started almost exclusively as a contract firm for NIH but has moved markedly in the opposite direction in recent years. "We are moving into the commercial arena to minimize the fluctuations of federal funding," Biotech President Thomas Li said.

"When I think of companies with strong NIH ties, I think of firms in Philadelphia," said Parag Saxena, an analyst with Citibank in New York. "When something is right there, sometimes poeple don't take advantage of it. I know lots of people in New York who have never been up the Empire State Building. But I know that whenever I have visitors, that's the first thing they want to see. It's the same thing with Maryland firms and NIH."



BY LUCIAN PERKINS—THE WASHINGTON POST

NIH's Itzhak Jacoby: "We've gone about as far as a federal agency can" in meeting industry.

Yet while restructuring NIH along the lines of a university might spark increased interaction with the surrounding industrial biotech community, NIH officials are quick to point out that substantial differences remain between the way in which government labs and universities relate to industry.

For one thing, NIH does not have the same dependence on the private sector for research money as do universities. While universities scramble to find new sources of cash from the business community, NIH is performing the opposite function. Last year it doled out $3.7 billion for research grants all over the country, with $44.5 million specifically targeted to small business.

Furthermore, while many academic scientists are given wide freedom to consult with private industry, in some cases being granted one paid working day a week for that purpose, the outside activities of NIH researchers are strictly controlled. Government scientists can't consult on anything directly related to their work—just on general knowledge—and have to do it on their own time. Further, they're limited to total annual outside earnings of $25,000, with no more than half of that figure from any one company.

"Getting access to scientists directly is a real problem," complained Steve Turner, CEO of the Gaithersburg biotech firm, Oncor. "Science itself has no value unless you can work with the people directly. If the Washington area ever wants to really compete with Boston and San Francisco it has to unleash the human potential which is presently locked up by the government."

But change is unlikely, some officials said.

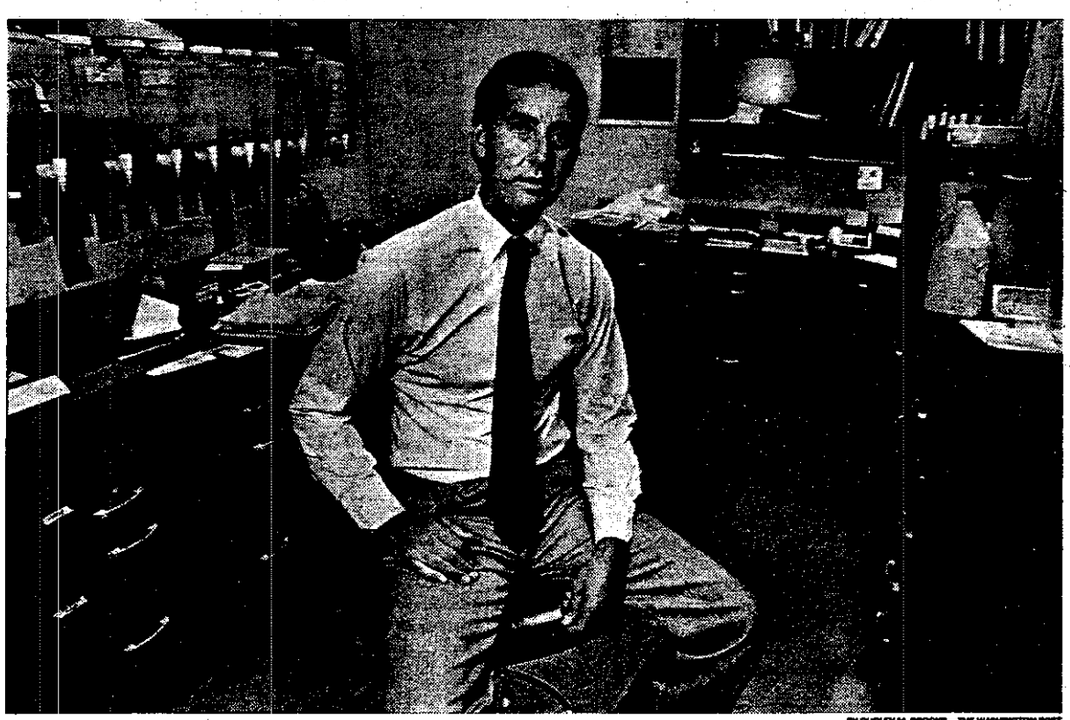
"We've gone about as far as a federal agency can. We're a government agency and have to be held accountable to the public," Jacoby said, and other NIH officials spoke of the need for government employes to be "purer" than those in the private sector. Until a few years ago, NIH employes weren't allowed to consult with industry at all.

That commitment to basic research limits the immediate commercial potential of government research.

Bionetics Research Inc. in Rockville, for example, has a fairly close relationship with the National Cancer Institute at NIH. Bionetics is pooling its production facilities with NIH's clinical resources in search of a diagnosis for colon cancer. The principal result of the collaboration won't be a product for market, however, but a research paper for general publication. Working with NIH, said Michael Hanna, vice president and director of research for the firm, "takes us only 10 percent of the way. We have to do the rest of the work ourselves."

According to Richard Nelson, a professor of political economy at Columbia University in New York, industry-government relationships are "often very fruitful. However with few exceptions the benefit to the company is not a process or product but general help, understanding of how to do things."

J. Leslie Glick, formerly of Genex Corp. and now president of Bionix Corp. of Potomac, said, "We are going to see a lot more of these arrangements in the future. It permits a type of interaction with NIH that until recently you just couldn't have." ■



BY DUDLEY M. BROOKS—THE WASHINGTON POST

Oncor's Turner: "Getting access to scientists directly is a real problem. Science itself has no value unless you can work with the people directly."

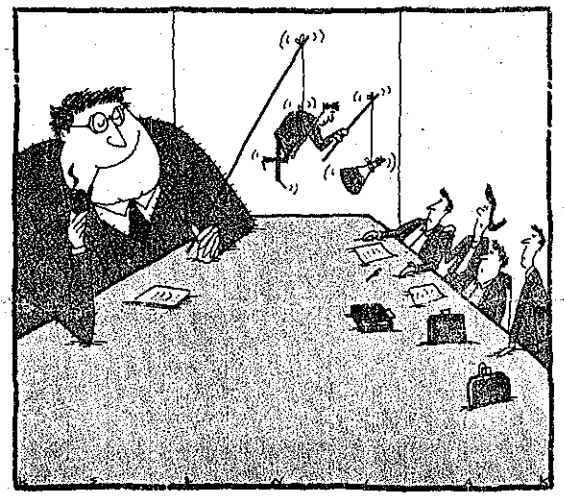
The Startup Insurance Trap

MEETING LICENSING DEMANDS CAN KILL SMALL COMPANIES

By Anne Simon Moffat

MEDSENTRY MAKES tiny water beds that could help save the lives of premature babies. An air pump sloshes water around in irregular wave patterns, simulating conditions inside the uterus and presumably easing the newborn's adjustment to the world. The novel water bed fits in standard incubators.

The product may not make it to market, however. The small company, run by the husband-and-wife team of Larry and Sue Browne in Santa Barbara, Calif., faces a financial crisis. The company licensed the technology the product uses from Stanford University, and the small startup (last year's sales: $62,000) cannot afford the liability insurance that Stanford is demanding as part of the licensing arrangement.



MARK KSENIAK

Such conundrums are not unique. Idec, a company in La Jolla, Calif., that is developing an antibody-based cancer therapy that uses Stanford research, almost hit the same dead end. The licensing deal was saved only after the university, which normally requires its licensees to have $5 million in insurance when they do clinical trials, agreed to be satisfied with the $500,000 insurance that the company could get.

The spectre of liability litigation has dampened the enthusiasm of many universities for licensing deals—a trend that threatens to cut small companies off from what has been a fertile source of new products. Particularly hard-hit are the high-risk arenas of medical equipment and pharmaceuticals. The liability issue is arising with greater frequency as universities increasingly conceive products in those fields and attempt to commercialize them. Even though the business that markets a product would be named in any liability suit, the plaintiff usually goes after everyone related to the product involved, and a wealthy licensor makes an especially juicy target. Top-notch research universities like Stanford and the Massachusetts Institute of Technology worry that their endowments, often amounting to hundreds of millions of dollars, will come under attack.

As a result, businesses that want to turn university research into profitable products are running into increasingly stringent demands from the universities. Those demands often create a Catch 22 for licensees: they can't get the technology unless they meet university demands, but meeting university demands may leave them financially unable to develop and market the product.

The insurance that universities require can kill a company before it gets going. Because many high-tech fields have no track record on which insurance companies can base risk estimates, insurance rates can be exorbitant—as much as $90,000 for $400,000 of protection.

Businesses also must sometimes deal through a middleman rather than directly with the school. For example, University Patents Inc. of Westport, Conn., specializes in taking title to patents and negotiating with prospective licensees. Although this arrangement appeals to some companies because it lets them negotiate with another business rather than an academic bureaucracy, the involvement of a middleman adds cost.

Universities also try to protect themselves from litigation by licensing concepts rather than products and barring an inventor from further involvement—financial or otherwise—in the company. From a business perspective, such a requirement can be an advantage; it's generally cheaper to license a product at a very early stage of development. The catch is that a company may be deprived of the inventor's expertise.

"Some sanity to tort law is needed to give entrepreneurs—and universities—a fighting chance," says John Preston, MIT's director of technical licensing. Until recently, there was hope that new legislation might stem the tide of liability suits and ease the commercialization of research by putting a time limit on claims and by eliminating licensors from liability, except in cases of clear negligence. But this year's juggling of congressional committees dimmed that prospect: The chairman of the Committee on Commerce, Science, and Transportation is U.S. Senator Ernest Hollings, an outspoken advocate of trial attorneys. Few expect the present Congress to change the law.

In the meantime, the small firms that have hit snags because of universities' fear of litigation are trying to find their own solutions. Says MedSentry's Sue Browne: "We are seeking to be bought out, hoping that a larger company can afford the insurance we need to continue doing business." ■

Anne Simon Moffat is a free-lance writer.

Harvard Business Review
March-April 1986

Robert B. Reich and Eric D. Mankin

Joint ventures with Japan give away our future

Listen to what these four businessmen have to say about U.S.-Japanese joint ventures:

"They buy energy-intensive components here, like glass, tires, and steel. But when it comes to things that are labor-intensive, that stays in Japan."—Terrence J. Miller, official, Automotive Parts and Accessories Association.

"People we used to do business with, we can't anymore [because they aren't competitive]. Instead of buying a given part from a supplier down the street in Chicago, I buy it from a supplier down the street in Osaka."—Robert W. Galvin, chairman, Motorola.

"Cross & Trecker is committed to the business of machine tools, but it is not committed to build in the United States all or any portion of the machine tools that it sells here."—Richard T. Lindgren, president, Cross & Trecker.

"First you move the industrial part to the Far East. Then the development of the product goes there because each dollar you pay to the overseas supplier is ten cents you're giving them to develop new devices and new concepts to compete against you."—C.J. Van der Klugt, vice chairman, Philips N.V.

Each of these businessmen is commenting on aspects of a trend that is reshaping America's trade relations with Japan and creating a new context for international competition. Very simply, this is the situation: to avert rising U.S. protectionist sentiment, Japanese companies are setting up plants in the United States, either as joint ventures or on their own; to obtain high-quality, low-cost products and components, U.S. companies are making joint venture agreements with Japanese companies. At the same time, U.S. companies are licensing their new inventions to the Japanese. (The *Exhibit* lists recent U.S.-Japanese coalitions in high-technology industries.)

Mr. Reich, who teaches political economy and management at Harvard's John F. Kennedy School of Government, was director of policy planning at the Federal Trade Commission during the Carter administration. His most recent book is New Deals: The Chrysler Revival and the American System *(Times Books, 1985).*

Mr. Mankin is a doctoral candidate in economics and business at Harvard University. His research focuses on production management and industrial organization.

"The big competitive gains come from learning about manufacturing processes—and the result of the new multinational joint ventures is the transfer of that learning from the United States to Japan."

On the surface, the arrangements seem fair and well balanced, indicative of an evolving international economic equilibrium. A closer examination, however, shows these deals for what they really are—part of a continuing, implicit Japanese strategy to keep the higher paying, higher value-added jobs in Japan and to gain the project engineering and production process skills that underlie competitive success.

In contrast, the U.S. strategy appears dangerously shortsighted. In exchange for a few lower skilled, lower paying jobs and easy access to our competitors' high-quality, low-cost products, we are apparently prepared to sacrifice our competitiveness in a

host of industries – autos, machine tools, consumer electronics, and semiconductors today, and others in the future.

Before this trend becomes an irrevocable destiny, U.S. business and government leaders need to review the facts carefully and decide if they should follow a different course. Two questions, in particular, frame the issue: What skills and abilities should be the basis for America's future competitive performance? And how does the current strategy of Japanese investments and joint ventures affect those skills and abilities?

The quotes cited earlier and an examination of U.S.-Japanese coalitions across a range of industries suggest disturbing answers to these questions. Through these coalitions, Japanese workers often gain valuable experience in applications engineering, fabrication, and complex manufacturing – which together form the critical stage between basic research and final assembly and marketing. U.S. workers, in contrast, occupy the two perimeters of production: a few get experience in basic research, and many get experience in assembly and marketing.

But the big competitive gains come from learning about manufacturing processes – and the result of the new multinational joint ventures is the transfer of that learning from the United States to Japan. The Japanese investment in U.S. factories gives the Americans experience in component assembly but not component design and production. Time after time, the Japanese reserve for themselves the part of the value-added chain that pays the highest wages and offers the greatest opportunity for controlling the next generation of production and product technology.

In the auto industry, for example, General Motors has formed a joint venture with Toyota, while Chrysler has teamed up with Mitsubishi, and Ford with Mazda. All three deals mean that auto assembly takes place in the United States. But in each case, the U.S. automakers delegated all plant design and product engineering responsibilities to their Japanese partners. The only aspect of production shared equally is styling. Under the Chrysler-Mitsubishi agreement, the joint venture will import the engine, transmission, and accelerator from Japan.

Or take the example of the IBM PC, which is assembled in the United States. The total manufacturing cost of the computer is about $860, of which roughly $625 worth, or 73%, of the components are made overseas. Japanese suppliers make the graphics printer, keyboard, power supply, and half the semiconductors. America's largest contribution is in manufacture of the case and assembly of the disk drives and the computer.

This trend spells trouble. If a Japanese company handles a certain complex production process, its U.S. partner has little incentive to give its skilled workers the time and resources required to design and debug new products and processes. Thus as their employers turn to Japanese partners for high value-added products or components, America's engineers risk losing the opportunity to innovate and thereby learn how to improve existing product designs or production processes.

Unless U.S. workers constantly gain experience in improving a plant's efficiency or designing a new product, they inevitably fall behind the competition. This is especially true in high-technology sectors, where new and more efficient products, processes, and technologies quickly render even state-of-the-art products obsolete. For example, as the Japanese moved from supplying cheap parts to selling finished products in the consumer electronics industry, vital U.S. engineering and production skills dried up through disuse. The U.S. work force lost its ability to manufacture competitive consumer electronics products.

The problem snowballs. Once a company's workers fall behind in the development of a rapidly changing technology, the company finds it harder and harder to regain competitiveness without turning to a more experienced partner for technology and production know-how. Westinghouse, for example, closed

Exhibit **A sampling of U.S.-Japanese joint ventures**

Bendix-Murata Manufacturing Company	Machine tools
Boeing-Mitsubishi Heavy Industries Boeing-Kawasaki Heavy Industries Boeing-Fuji Heavy Industries	Airplanes
Armco-Mitsubishi Rayon	Lightweight plastic composites
General Motors-Fujitsu Fanuc	Machine tools
General Motors-Toyota	Automobiles
Ford-Mazda	Automobiles
Chrysler-Mitsubishi Motors	Automobiles
Westinghouse-Komatsu Westinghouse-Mitsubishi Electric	Robots and small motors
IBM-Matsushita Electric	Small computers
IBM-Sanyo Seiki	Robots
Allen Bradley-Nippondenso	Programmable controllers and sensors
General Electric-Matsushita	Disc players and air conditioners
Kodak-Canon	Copiers and photographic equipment
Sperry Univac-Nippon Univac	Computers
Houdaille-Okuma	Machine tools
National Semiconductor-Hitachi	Computers
Honeywell-NEC	Computers
Tandy-Kyocera	Computers
Sperry Univac-Mitsubishi	Computers

its color television tube factory in upstate New York ten years ago because it could not compete with Japanese imports. That same plant will soon reopen as a joint venture with Toshiba – but only because Toshiba is supplying the technology. Westinghouse engineers, who had not worked on color television tubes for at least a decade, could not develop the technology alone.

On the other hand, continual emphasis on and investment in the production part of the value-added chain will result in low-cost, high-quality products and a steady stream of innovations in products and processes. If current trends persist, Japanese companies will keep gaining experience and skill in making products. They will continue to develop the capacity to transform raw ideas into world-class goods, both efficiently and effectively.

The implications of this trend for U.S. companies, workers, and the national economy are uniformly bad. The Japanese are gradually taking charge of complex production – the part of the value-added chain that will continue to generate tradable goods in the future and simultaneously raise the overall skill level of the population. The entire nation benefits from a large pool of workers and engineers with skills and experience in complex production.

The United States, however, will own only the two ends of the value-added chain – the front end, where basic research and invention take place, and the back end, where routine assembly, marketing, and sales go on. But neither end will raise our overall skill level or generate a broad base of experience that can be applied across all kinds of goods.

As more and more production moves to Japan, our work force will lose the capacity to make valuable contributions to production processes. An economy that adds little value to the production process can hardly expect to generate high compensation for less valuable functions. If the current trend continues, our national income and standard of living may be jeopardized.

Japan's investment in America

Japanese investment in the United States has given rise to automobile plants producing Nissans, Hondas, Toyotas and, in the near future, Mazdas and Mitsubishis. Japanese semiconductor and computer manufacturers have helped create a "silicon forest" in Oregon. In the last four months of 1984, Japanese electronics companies established 40 new plants in the United States that produce everything from personal computers to cellular mobile telephones. According to the Japan Economics Institute, there are now 522 factories in the United States in which Japanese investors own a majority stake.

Japanese companies are also building laboratories here. Nippondenso's research center in Detroit will focus on automobile electronics and ceramics, and Nakamichi's in California will develop innovations in computer peripherals. Furthermore, nearly every major Japanese company now funds research at American universities in return for the right of first refusal in licensing any products or technologies that are developed.

Although Japanese companies fund basic research at American universities, the results of that research go back to Japan for commercialization. At the other end of the manufacturing process, Japanese plants in the United States take the results of complicated production done in Japan and assemble the final products. NEC's new computer facility in Massachusetts assembles computers from Japanese central processing units and memory chips. The most sophisticated components and systems of automobiles are apt to be produced in Japan, even if the car is assembled in Michigan, California, or Tennessee.

Heart of the matter

At the heart of a growing number of U.S.-Japanese joint ventures is the agreement that the Japanese will undertake the complex production processes. These agreements need not automatically turn out this way. In fact, there are many different types of international joint venture, and each type has different implications for production, distribution, and division of profit between the partners.

Consider the recent agreement between AT&T and Philips N.V., under which Philips will distribute AT&T products in Europe. The two companies each contributed resources to the formation of a new jointly owned entity. AT&T's stated goal was to enter the European market; Philips presumably wanted access to AT&T's products. AT&T could have sold Philips an exclusive European license to manufacture and distribute its products; it could have leased Philips's factories or built its own in Europe and used Philips as a distributor; or it could have bought Philips, a move that would have given it the Dutch company's factories and distribution network, as well as all of its proprietary products.

U.S. companies planning joint ventures with Japan usually find that at least one of these options is unavailable: they cannot buy a Japanese company. Still, U.S. companies can enter a wide range of potential joint venture agreements. Most of the high-technology joint ventures that we examined, however,

were agreements in which the U.S. partner would sell and distribute the Japanese product; our study of 33 joint ventures between U.S. and Japanese companies in consumer electronics industries showed that roughly 70% took this form.

Under the typical agreement, the U.S. company buys products from its Japanese partner and sells them in the United States under its own brand name, using its own distribution channels. The IBM graphics printer is made by Epson in Japan. The Canon LBP-CX laser printer is manufactured in Japan and sold in the United States by Hewlett-Packard and Corona Data Systems. Even Eastman Kodak is joining the bandwagon: Canon of Japan will make a line of medium-volume copiers for sale under Kodak's name; Matsushita will manufacture Kodak's new video camera and recorder system, called Kodavision.

This type of arrangement is not unique to U.S.-Japanese joint ventures; European high-technology computer, semiconductor, and telecommunications companies are also entering into a disproportionately large number of sales and distribution agreements with the Japanese.

For many U.S. managers, these joint ventures make good business sense. Faced with seemingly unbeatable foreign competition, many U.S. companies have decided that it is more profitable to delegate complex manufacturing to their Japanese partners. Consider Houdaille Industries, a Florida-based manufacturer of computer-controlled machine tools. Beginning in 1982, the company set out to block imports of competing Japanese machine tools. It petitioned Washington for protection, accusing the Japanese of dumping and receiving subsidies from the Japanese government. When that strategy failed, Houdaille tried to persuade the Reagan administration to deny the 10% federal investment tax credit on equipment to U.S. buyers of Japanese machine tools. The administration rejected this proposal as well. Finally, Houdaille announced that it would seek a joint venture with Japan's Okuma Machinery Works.

The machine tool story

Houdaille is not the only machine tool manufacturer to look for Japanese partners. James A.D. Geier, chairman of Cincinnati Milacron, the nation's largest machine tool manufacturer, noted in 1984 that "50% of the products we sold last year did not even exist five years ago. We've gone from being an industry with very little change in products to one with a revolutionary change in products." Many U.S. companies were unprepared for such a transition and as a result can make money only by selling advanced products manufactured in Japan. In 1983, more than 75% of all machining centers sold in the United States were made in Japan (even though many ended up with American nameplates), and domestic production has declined dramatically.

As imports have increased, international joint venture activity in the machine tool industry has accelerated. A recent National Research Council report on machine tools noted that "most of these joint ventures have offered the potential for low-cost, reliable overseas manufacturing for the U.S. partner, and an enhanced marketing network in this country for the foreign one."[1] For example, Bendix sells a small turning machine in the United States for $105,000. It can produce the device in Cleveland for $85,000. The same machine, produced in Japan by Bendix's new partner, Murata Manufacturing, and then shipped to Cleveland, costs the company only $65,000. Such compelling economics underlie Bendix's decision to transfer nearly all its machine tool production to Japan.

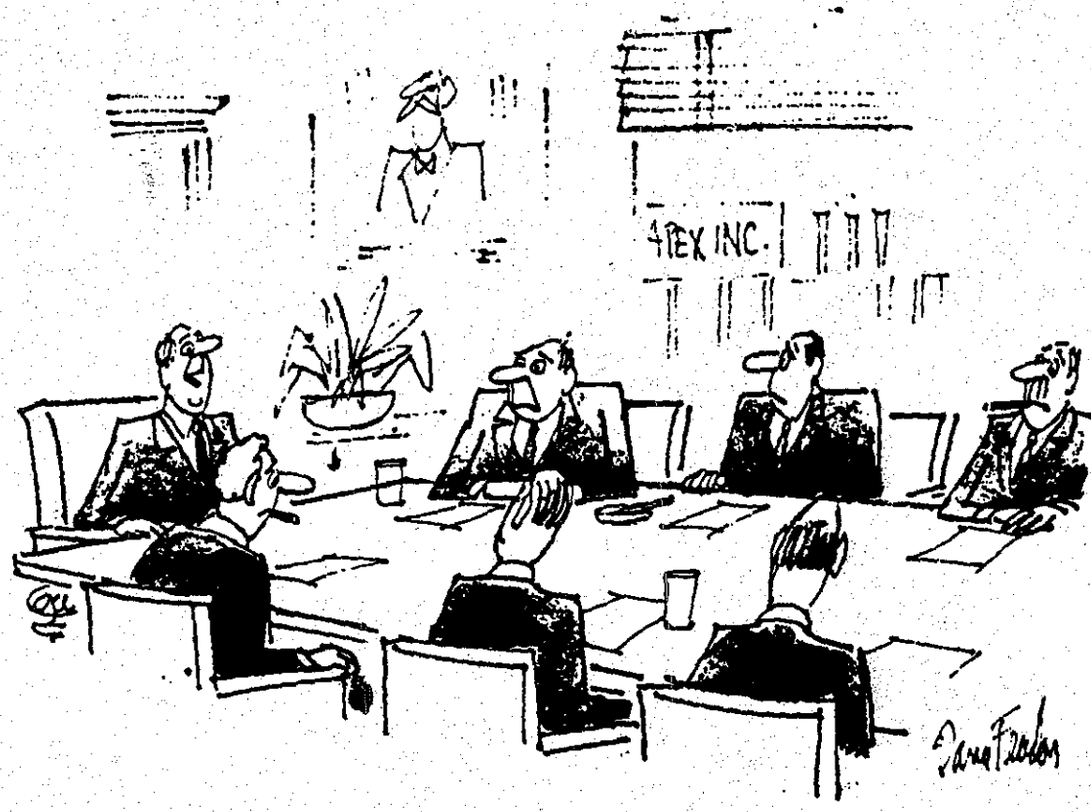
Or consider the case of Pratt & Whitney, which earns profits by distributing foreign-made machine tools. In July 1984, its president, Winthrop B. Cody, told the *New York Times*: "I wish we could make some of these machine tools here, but from a business point of view it's just not possible." Even U.S. companies that develop new products look to Japan for manufacturing. Acme-Cleveland's state-of-the-art numerically controlled chucker, jointly developed with Mitsubishi Heavy Industries, will be produced in Japan.

The semiconductor story

While not in quite the same straits as machine tool producers, U.S. semiconductor manufacturers also face increasing competition from Japan and thus increasing pressure to enter into coalitions with Japanese companies. Traditionally, the Japanese have entered semiconductor markets as followers, thereby enabling U.S. companies to reap high profits before the product's price drops. Once the Japanese enter, they rapidly gain market share by competing on the basis of a lower price.

Some of the most famous examples of the "Japanese invasion" come from the memory chip wars of 1973-1975 and 1981-1983, when U.S. chip makers ceded a large part of the 16k and then the 64k dynamic memory market to Japanese manufacturers producing at lower cost. In the spring of 1984, Japanese manufacturers controlled about 55% of the U.S. market for 64k RAM chips. Taking a lesson from these bat-

[1] Committee on the Machine Tool Industry, Manufacturing Studies Board, Commission on Engineering and Technical Systems, National Research Council, *The U.S. Machine Tool Industry and the Defense Industrial Base*, Washington D.C., National Academy Press, 1983, p. 44.



"Look at it this way, gentlemen. Minimum tax is better than maximum tax."

tles, some U.S. companies decided to delegate production to the Japanese at the start of a new project: in 1982, Ungermann-Bass made an agreement with Japanese chip maker Fujitsu by which Ungermann-Bass designs very large scale integrated circuits for local area networks. The company then sends the designs to Fujitsu in Japan for manufacturing.

Innovations and new products in the semiconductor industry are a predictable function of experience and engineering know-how: 16k RAM chips precede 64k RAMs; the development of the 16-bit microprocessor follows logically from the existence of its 8-bit forebear. Since technological leadership is linked so closely to production experience, the emergence of pioneering Japanese products will only be a matter of time. In December 1984, for example, Hitachi introduced a 32-bit microprocessor, thus signaling its intention to compete aggressively against U.S. companies in leading-edge semiconductor technologies. While both Motorola and National Semiconductor are producing a 32-bit chip, Hitachi's entry predates Intel's new product announcement. Intel introduced its new 32-bit microprocessor in October of 1985.

Hitachi's push toward state-of-the-art semiconductor production foreshadows a new round of sales and distribution agreements. Soon executives at Intel or National Semiconductor will realize that Hitachi or another Japanese semiconductor manufacturer can sell advanced semiconductor products at prices that U.S. companies cannot match. These semiconductor companies might go to Washington looking for trade protection. More likely, however, they will try to preserve their profitability by negotiating sales and distribution agreements. National Semiconductor already has trading ties with Hitachi through which it markets Hitachi's computer in the United States.

A comparison of two joint ventures – National Semiconductor-Hitachi and Amdahl-Fujitsu – illustrates the different approaches U.S. and Japanese companies take toward joint ventures. Fujitsu and National Semiconductor both fabricate integrated circuits, while Hitachi and Amdahl manufacture IBM-compatible mainframe computers. Both ventures link a computer and a semiconductor manufacturer.

The agreement between National Semiconductor and Hitachi is similar to sales and distribution agreements in other industries. In an attempt to diversify downstream, National Semiconductor will sell Hitachi's IBM-compatible mainframe computers in the United States. Hitachi, however, will be under no obligation to use any National Semiconductor products in making its computer. National Semicon-

ductor may thus find itself in the position of manufacturing chips for Hitachi's competitors while selling a Japanese-made computer that contains none of its own components.

In contrast, Fujitsu purchased a controlling interest in Amdahl in 1983. As a result, Amdahl will now buy from Fujitsu most of the semiconductors it uses in the manufacture of its mainframe computers. Fujitsu will not, however, sell Amdahl computers in Japan. In both cases, Japanese companies add to their manufacturing experience. Complex production stays in Japan, and the final products are sold in the United States.

The story behind the stories

What lies behind Japan's direct investment in the United States and the coalition-building activities of U.S. and Japanese high-technology companies? What motivates U.S. and Japanese managers?

The Japanese hope to mitigate future U.S. trade barriers by investing in the United States and allying with U.S. companies. In 1981, nontariff import restrictions protected about 20% of U.S. manufactured goods; by 1984, protection covered 35%. To the Japanese, the trend is clear. If the Reagan administration succumbed so readily to protectionism, what can the Japanese expect from future administrations that may be less ideologically committed to free trade? Mazda is investing $450 million in a new auto assembly plant in Flat Rock, Michigan because quotas had prevented Mazda from importing enough cars to meet demand. Despite the recent expiration of voluntary import restraints on Japanese automobiles, Chrysler and Mitsubishi came to an agreement in April 1985 to assemble Mitsubishi automobiles in Illinois. Concern over future trade barriers was a strong motivating factor for Mitsubishi.

From the Japanese perspective, joint ventures with U.S. companies will also help forestall further protectionism. RCA was notably absent from the 1977 dumping case over Japanese color television sets. Because it had licensed technology to Japanese television manufacturers, RCA was benefiting from Japanese imports. In the same way, now that RCA is distributing a PBX system manufactured by Hitachi, it has no interest in pushing for trade barriers in telecommunications equipment.

In both joint ventures and direct investments, U.S. companies and workers become partners in Japanese enterprises. Japanese direct investment puts Americans to work assembling Japanese-made components. Joint ventures and coalitions employ Americans selling Japanese products. If trade barriers limit the flow of products from Japan, American workers will lose their jobs assembling and distributing these goods and U.S. corporations will lose money.

Why do U.S. companies find joint ventures with Japanese companies so attractive? Companies in emerging industries often view a joint venture with a Japanese company as an inexpensive way to enter a potentially lucrative market; managers in mature industries view the joint venture as a low-cost means of maintaining market share. In industries ranging from consumer electronics to machine tools, the Japanese have the advanced products American consumers want. Joint ventures allow U.S. companies to buy a product at a price below the domestic manufacturing cost. The Japanese partner continues to move down its production learning curve by making products destined for U.S. markets. Thanks to these joint ventures and coalitions, the efficiency gap between U.S. and Japanese manufacturing processes will continue to widen.

A Japanese strategy

The trends of the past 40 years as well as current Japanese actions in the United States suggest the existence of a long-term Japanese strategy. The overriding goal of Japanese managers is to keep complex production in Japan. They intend to develop national competitive strength in advanced production methods. U.S. managers who want to take advantage of Japan's manufacturing strength may do so by selling Japanese products in the United States. They may also set up production facilities in Japan, provided they are run and staffed by Japanese.

Increasingly, American managers are aiding the Japanese in achieving their goals by channeling new inventions to Japan and providing a sales and distribution network for the resulting products. Burroughs and Hewlett-Packard, for example, have just set up buying offices in Japan to procure high-tech components from Japanese manufacturers. Over the next five years, we expect sales and distribution agreements to result in lower profitability and reduced competitiveness for the U.S. companies that enter into them.

The reason is simple: the value provided by the U.S. partner in a sales and distribution agreement is potentially replaceable. The U.S. company gives away a portion of its market franchise by relying on a Japanese company for manufactured products – in essence, it encourages the entry of a new competitor. As shown by the Japanese-dominated consumer elec-

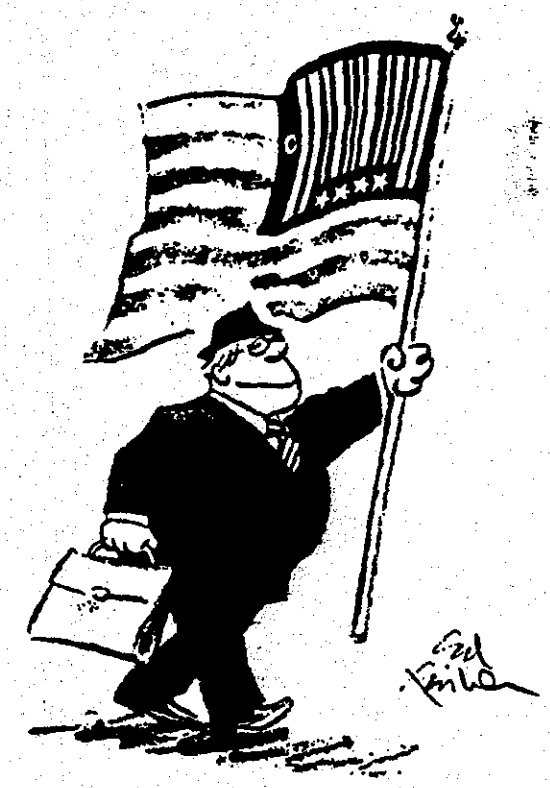
tronics industry, these agreements can act like a Trojan horse: the U.S. company provides the Japanese company access to its customers, only to see the Japanese decide to go it alone and set up a distribution network on the basis of a reputation gained with the help of the U.S. partner. Even if the Japanese do not terminate the agreement after establishing a presence in the United States, Japanese manufacturers are in a position to squeeze their U.S. distributors' profit margins precisely because sales and distribution functions are so vulnerable to replacement.

U.S. companies are selling themselves too cheaply; in letting their Japanese partners undertake product manufacturing, they are giving away valuable production experience. Instead, U.S.-based companies could begin to invest in more sophisticated production within the United States. They could seek to develop in our work force the same base of advanced manufacturing experience that Japanese managers are now creating among their workers. Unfortunately, from the standpoint of a typical U.S. company, the guaranteed return on this sort of an investment is often not enough to justify its cost, especially when the alternative of Japanese manufacture is so easy to choose.

Production experience is essentially social. It exists in employees' minds, hands, and work relationships. It cannot be patented, packaged, or sold directly. It is thus a form of property that cannot be claimed by the managers who decide to invest in it and the shareholders they represent. This form of property belongs entirely to a company's work force. It will leave the company whenever the workers do.

An economic fable

Imagine the following: the chief executive of a U.S. company decides to invest in production experience. Instead of relying on a Japanese supplier for a complex component, top management decides to produce it in America, inside its own operation. The component costs more to produce here than in Japan – the equivalent of $1,000 more per employee. The higher cost partly reflects the overvalued dollar, but it occurs mainly because the Japanese have already invested in producing this component cheaply and reliably. The chief executive sees the added expense as an investment. Once the workers and engineers gain experience in making the component, they will be better able to make other products. They will learn about the technology and will be able to apply that learning in



countless ways to improve the company's other processes and products. As a result, the company will gain $1,500 per worker in present-value terms. Thus the initial $1,000 investment is well worth it.

As might be imagined, the chief executive cannot get anywhere near the $1,500 return envisioned from this investment. As soon as the workers and engineers realize their increased value, they ask for more money. In this fable, they can, of course, ask for $1,499, since they are now worth an extra $1,500.

If the executive refuses to give the workers a raise, they can simply leave the company and work for the competition. Faced with a sizable loss on the investment, our executive vows that from now on the company will buy advanced components from Japan.

This fable is not so farfetched. Studies show that companies retain an average of only 55% of their engineering trainees after two years. In one study, the factor cited most often by departing engineers was "inadequate compensation," followed closely by "uncertain future with the company" and "higher salary offer elsewhere."[2] Thanks to such high job mobility, the engineers responsible for developing a new product or designing a cost-saving manufacturing process at one company in one year may find themselves using their expertise to help another company in another year – perhaps their first employer's chief competitor. Thus, companies that invest in production experience may ultimately produce profits for the competition.

2 Eugene Raudsepp, "Reducing Engineer Turnover," *Machine Design*, September 9, 1982, p. 52

3 Andrew Weiss, "Simple Truths of Japanese Manufacturing," HBR July-August 1984, p. 119

The Japanese system of lifetime employment eliminates this problem. While not all Japanese companies subscribe to such a policy, most of the large companies making advanced products for export do. This system makes it unthinkable for workers to join the competition; they would leave behind friends, homes, social status—in short, much more than a job. In this atmosphere, an investment in production experience comes quite naturally. Benefits resulting from such an investment tend to remain with the company.

Furthermore, because of the abundance of engineers and because engineers stay with their original employers, Japanese managers can give factory workers more engineering support. As Andrew Weiss noted in an HBR article, for high-volume, low-technology products like radios, the ratio of production workers to engineers in Japan is about four to one. In divisions making more sophisticated products, such as very large scale integrated circuits, the Japanese manufacturers observed by Weiss employed more engineers than production workers. Weiss attributes the high levels and rapid increases in Japanese companies' labor productivity to heavy investment in engineering.[1] Most conventionally organized U.S. companies, faced with high turnover, cannot afford to invest so heavily in their engineers.

As a result of these organizational differences, U.S. managers have little incentive to invest in production experience. The Japanese, however, will be able to capture most of the returns from their investments in Japanese workers. U.S. managers are happy to buy components from the Japanese or build new factories in Japan, thus further contributing to the production experience of the Japanese work force. But what is really at stake is not where company headquarters are located or profits remitted, but rather the value added by a nation's work force to an increasingly global process of production and the capacity of that work force to generate new wealth in the future. We are falling behind in this high-tech race, and actions taken by both U.S. and Japanese companies only serve to further weaken the U.S. work force.

Changing course

The current situation has severe drawbacks for U.S. companies over the next five years. Over the long term, U.S. companies that enter joint ventures with Japan cannot maintain high profitability by providing services, such as assembly and distribution, which add very little value to the product being sold. The resulting interplay, while superficially promising, could really be just an extended dance of death.

Profit sharing?

As profits dwindle, management might at last look to profit sharing or other forms of employee ownership that reduce turnover rates. The lower the turnover, the more profitable are investments in the work force. Furthermore, profit-sharing programs will enable workers to gain directly from a company's investments in them. To return to our fable, when workers in a company practicing profit sharing demand their raises, our chief executive need only say, "Wait, and you will get higher compensation when our investments start paying off and the company makes more money."

In practice, however, it may be impossible to devise a profit-sharing system that solves the problem. In a large company, for example, employees of different divisions would have to be compensated based on their divisional performance—a difference sure to create resistance to transfer among divisions, which makes it hard to share production experience. Furthermore, a new system of ownership and an immediate change in managerial or worker attitudes do not automatically go together. Consider Hyatt Clark Industries of Clark, New Jersey, a worker-owned company in which management refused to distribute company profits, or the Rath Packing Company of Waterloo, Iowa, a worker-owned company in which the workers went out on strike.

Moreover, corporate objectives are often inconsistent with a goal of profit sharing or employee ownership. Unlike workers, corporations can move overseas. Why make risky investments in workers when safer Japanese alternatives present themselves? If we wait for U.S. corporations to increase their investments in their workers, we may have to wait too long. The plants that these companies will eventually sell to their workers will be obsolete, and America's comparative disadvantage will be too great to overcome.

Public benefits, private costs

In this situation, government has an appropriate role. The difference between the social and private returns on investments in production experience is an example of what economists call an "externality." Other examples of externalities abound: when a company pollutes the air, it is using a public resource—clean air—for which it is not paying. The private company is, in essence, shifting a cost to the public—and thereby boosting its rate of return at public expense. In this case, government's role is to ensure that the company's costs reflect the value of resources used in production. The clean air regulations of the

1970s made managers include the costs of pollution—or pollution cleanup—in their investment decisions.

In the case of production experience, the balance between cost and reward is reversed: society as a whole benefits more than do most companies from investments in workers and engineers. Government should thus create incentives for companies that are doing business in the United States—regardless of where the company is headquartered—to invest in complex production here, using American workers and engineers. Companies should reap an extra public reward for investing in production experience to make up for the diminished short-term private reward of doing so. The government could subsidize investments in production experience through, for example, a human investment tax credit. The object would be for government to accept part of the economic cost of creating an important national economic good: more highly skilled, trained, and experienced workers and engineers.

In addition, government could support private investment in production experience in other, less direct ways. Federal and state governments could sponsor "technology extension services" modeled on the highly successful agricultural forerunner. An extension service could inform smaller businesses about the latest methods in manufacturing technology and undertake pilot programs and demonstrations. By sharing information and conducting classes, an extension service could help smaller manufacturers—the underpinnings to the industrial base—keep pace with change.

For another perspective on this same topic, see "Cooperate to Compete Globally" by Howard V. Perlmutter and David A. Heenan on page 136 of this issue.

Antitrust laws could be modified to permit American companies to invest jointly in complex production in the United States, thereby spreading the cost of the investment over several companies. The Federal Trade Commission allowed General Motors and Toyota to form a joint venture; would it have also approved a GM-Ford deal?

Our future national wealth depends on our ability to learn and relearn how to make things better. The fruits of our basic research are taking seed abroad and coming back home as finished products needing only distribution or components needing only assembly. America's capacity to produce complex goods may be permanently impaired. As a production-based economy, the United States will be enfeebled. What will also be lost is the wealth—the value added—contributed by the center of the value-added chain. And that is a prospect that should concern executives and government leaders alike.

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RISK: PERCEPTION AND REALITY

Bruce Scott Levinson

ACTIVITY OR CAUSE	ANNUAL FATALITIES (One Million Individuals*)
1. Smoking	3,000
2. Motor Vehicle Accidents	243
3. Work	113
4. Murder	107
5. Radon (indoor air)	87
6. Groundwater Contamination from Inactive Hazardous Waste Sites	14
7. Saccharin	5
8. Lightning	0.5
9. DES in Cattlefeed	0.3
10. Uranium Mill Tailings (active sites)	0.02

The above table describes the risks associated with a variety of hazards. Although the nature and danger of the hazards vary, one conclusion is evident. There is little relation between the riskiness of a particular hazard and the level of resources the Federal government allocates to protect its citizens from that hazard.

This conclusion was reached by a recent EPA task force that examined threats to health and the environment. The task force found that budget priorities tended to reflect public perception of risk rather than actual risk levels.

Despite serious environmental problems such as radon exposure, stratospheric ozone depletion, and nonpoint source water pollution, the bulk of Federal environmental funds are focused on the comparatively low risk problem of groundwater contamination from Superfund and RCRA sites. Regulations being drafted under the latter statute could require an even disproportionately higher amount be spent on commercial and municipal solid waste landfills.

As the growth in public spending becomes increasingly limited, failure to target Federal funds to the most serious sources of real risk will result in the American people being exposed to needless danger. In addition, and possibly of greater financial significance, the expenditure of Federal funds in low priority areas could force the private sector to spend even greater sums on these areas.

Since perception drives policy, both education and political rhetoric may play a role as important as scientific facts in determining the course of actual environmental protection.

*Source: EPA / OMB Documents / Statistical Abstract of the U.S.