Chapter 2

Policy Issues and Options

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The U.S. approach to promoting particular industries has been mostly not to do it. Our underlying belief is that the national economic interest is best served by free and fair competition in the marketplace, at home and abroad. Whatever industry and trade profile results from this competition is in the national interest, and government interference is justified only when the competition is unfair or when national security is at stake. In practice, the government has intervened from time to time to support or protect certain industries. But this has been mostly ad hoc—a response to political pressures, not part of a strategy to build up competitive industries in areas of special importance.

Does this approach still make sense in a world where governments in most advanced industrial nations, including those of our most able competitors, are cooperating with private business to promote critically important industries? This study has concluded that, on the whole, free trade and vigorous competition are worthy, indeed essential goals, that must be steadily pursued. It has also found evidence from Japan, Korea, and Taiwan that selective, flexible government support of particular industries can pay off in rapid advances in technological achievement, export success, and national income. The European Community, preparing for the Single Market in 1992, is developing its own versions of support for critical industries within the Community. The core issue in this chapter is whether the United States, with its particular traditions and form of government, can combine selective promotion of strategic industries with a firm overall commitment to competition and free trade, and if so, what institutions and policy tools would be needed.

It can be argued that the U.S. form of government is open at so many places to capture by special interests that the chances of rational government decisions on aid to selected industries are slim. The good that government-industry cooperation might do in strategic fields (e.g., electronics) where we have lost competitive advantage could dissipate in expensive, useless handouts to industries whose main claim to special treatment is political clout.

This argument, however, can be stood on its head. Despite our free trade philosophy and commitment to open markets, the United States does make exceptions; it does grant some trade protection, and does sometimes subsidize favored economic sectors (e.g., price supports for farm products). Nearly always, these exceptions are motivated by politics. It is possible that a coherent strategy that first selects industries for support based on their contribution to the national good and then applies a judicious mix of supportive measures, including trade protection if needed, would result in more rational exceptions to a general regime of free trade.

Trade protection is only one part of the mix in a policy to promote strategic industries and is not by any means the dominant one. Trade protection on its own is unlikely to improve competitiveness, and in fact can have the opposite effect. If the only government action taken is to shield companies from competition, they often do not (except where there is still vigorous domestic competition) have the proper incentives to invest in technology development and diffusion, worker training, plant modernization, and other things that improve competitiveness. Another essential part of the mix is government partnership with industry in technology development, especially of high-risk technologies where the potential benefits to society are great but the prospect of returns to individual firms is too small or remote to justify a big investment. Still another part encompasses measures that spread the financial risks of adopting advanced product and process technologies to government as well as industry; such measures include indirect means, such as tax breaks that favor technology adoption.

Beyond these industry-specific strategies we broader government policies that shape the overall environment for all U.S. industries and affect their competitiveness. Taxes, spending, and the Federal budget deficit directly influence the cost of capital to firms. They wield indirect but powerful effects on our ability to compete through their influence on the growth and stability of the domestic economy and the international value of the dollar. Equally critical to industry's performance is the education of the Nation's children (a government responsibility) and the reeducation and training of adult workers (a responsibility shared by government and industry). Important as these policies are, this report cannot do

full justice to them all. Options to improve the financial environment for industry; to upgrade the training and education of managers, engineers, and workers; and to diffuse advanced and best practice technologies throughout industry are summarized here but have been covered in greater depth in earlier OTA reports.[1] This chapter gives more detailed consideration to strategies that select and combine trade, technology, and fiscal or financial policies to improve the competitiveness of particular U.S. manufacturing industries. The focus is on manufacturing, not only because it dominates international trade, but also because it pays for most privately funded R&D and provides well-paid jobs, not only in manufacturing but also in related service sectors.

The first question to ask is whether there is any need for exceptions to the Nation's free trade and free market policies. The answer starts with the strong evidence, in this report, other recent OTA reports, and elsewhere, that U.S. manufacturing is in trouble.[2] Moreover, certain industries that most people regard as essential to the further technological advance of the American economy and to rising standards of living are in trouble. This is true, for example, in parts of the semiconductor and computer industries. On the other hand, the United States is not in the position Japan was 40 years ago, when that nation was behind in nearly all advanced technologies and manufacturing industries and was prepared to make sacrifices for many years to catch up. Our troubles are not those of a poor or war-ravaged country but of a rich country that has lost its edge.

All this suggests that it may make sense to offer government help to particular industries. The U.S. Government has made several starts in that direction through technology policy, most notably in the Sematech project, where the government has gone halves with industry to develop better manufacturing processes for dynamic random access memory (DRAM) semiconductor chips, at a cost to the government of $500 million over 5 years. Yet in some critical cases, and major parts of the microelectronics complex may be among them, technology assistance is not enough. U.S. electronics companies lost their lead to Japanese competitors partly because of the Japanese fins' manufacturing excellence, but also partly because of support from the Japanese Government's trade, technology, and financial policies. Government support helped to create the large, rich, integrated Japanese electronics firms of the 1990s, whose deep pockets and command of certain critical technologies keep them a pace ahead of much of the U.S. industry. There is good reason to believe that the U.S. semiconductor industry will continue to lose ground without some trade policy help from the U.S. Government. And indeed, it has already received some trade relief as part of a broader arrangement with Japan, but while U.S. firms have gained a few percentage points' market share in Japan, mostly the results have been disappointing.[3] Nevertheless, the trade agreement and Sematech were unusual, perhaps unique, attempts by the U.S. Government to strengthen a domestic industry of strategic importance.

An advantage to the strategic approach to trade policy is that it could be proactive and planned to avoid pitfalls. And it could be based on a frank appraisal of the needs and interests of the United States without casting blame on other nations. In most cases, U.S. trade policy actions are based on findings that foreign firms are competing in ways labeled unfair: that they are dumping in the United States (selling below cost or below the prices they charge in protected markets at home), or that they are taking subsidies from their governments and thus undersell U.S. fins. There often is truth in these charges. But often the whole truth is more complex, including both genuine superiority in quality and price of the foreign goods and industrial policies of foreign governments that help their firms lower production costs and acquire new technology. Dumping or subsidies may be only a part, sometimes a minor part, of the problem. To require all U.S. trade policy actions to be based on findings of unfair trade is an irritant to amity among otherwise friendly nations and is particularly galling to our trading partners when it brands their governments' industry policies as "unfair." Imposing limited, conditional, and temporary trade restrictions as part of an overall U.S. strategy to strengthen vital domestic industries is less abrasive and, under certain limited conditions, is legal under current international agreements and U.S. trade law.

If the U.S. Government should opt to develop a strategic competitiveness policy, two essential conditions would have to be met. The first is an institutional capacity to plan and carry out the policy. At present the United States lacks this capacity. Responsibility is diffuse in the executive branch even for carrying out our present policy of urging free trade and threatening sanctions for unfair

practices. Judging by experience in the Pacific Rim and Europe, it is more effective to place the principal control over selective support for strategic industries in the hands of one or two strong agencies than to scatter it among many. Given enough interest in Congress and backing by the public, it is possible to create anew Federal agency with powers that did not exist before; witness the creation of the Environmental Protection Agency in 1970. Although an agency with power and prestige equal to that of Japan's MITI is highly improbable-and perhaps undesirable--in the American setting, it might nevertheless be possible to create an agency with the lead in competitiveness policy, a seat at the table in Cabinet meetings, and the ear of the President.

An alternative to creating a new lead agency is to use existing institutions, but assign them a much clearer mission of promoting the competitiveness of American industry. U.S. trade law already allows some leeway in pursuing this aim. What would be needed among the Federal agencies involved in trade, technology, and financial policy is a stronger understanding of which industries are critical to national economic security, better analysis of their competitive situation, closer relations with industry, and coordination of policy to support them.

This brings us to the second condition. Any strategic competitiveness policy, whether directed by a lead agency or coordinated among several lesser ones, needs wholehearted support from both Congress and the Administration. Congress can move independently in the direction of support for strategic industries. It has done so repeatedly in the past few years; for example, by creating the Sematech project via appropriations for the Defense Advanced Research Projects Agency (DARPA); by awarding DARPA funds to advance other technologies of commercial as well as military interest (e.g., flat panel displays for computers); and by setting up a purely commercial Advanced Technology program in the National Institute of Standards and Technology (NIST), under which government can take part with industry in R&D consortia. Recently, the Bush administration has moved toward supporting a government role in developing generic technologies that could have commercial application. If Congress were so inclined, it might by resolution declare its intent to adopt policies in support of selected industries. It is harder to conceive that Congress could unilaterally create both the capacity and the will within the government to carry out competitiveness policies.

Backing for such policies by both branches of government must rest on the understanding and support of the American people. There would have to be widespread comprehension that our national economic security is at some risk, agreement that government support for critical industries could be fruitful, and acceptance that government collaboration with industry to regain excellent performance in manufacturing is not cost-free. Trade protection always costs consumers. Programs for partnership between government and industry to develop new technologies or share the financial risks of adopting them cost the taxpayer something. More basically, massive Federal budget deficits, combined with our low personal savings rate, exert a steady upward pressure on interest rates that hikes the cost of capital for all U.S. industries. And the budget deficit cannot be greatly reduced without the pain of higher taxes, cuts in favorite government programs, or both.

One explanation for the success of the Japanese government-industry partnership is the existence of a "high-growth consensus" among consumers, workers, and taxpayers as well as government and business leaders, and a willingness to make sacrifices for that purpose.[4] Sacrifices of current income allowed long-term investments in technology, capital equipment, and human resources, which in turn helped to produce the large steady rises in income that Japanese citizens have enjoyed for more than 40 years. The same kind of consensus in the United States is a condition for the adoption of new government policies to restore our national competitive performance. And the same kind of future rewards-faster economic growth, increasing incomes for most citizens, healthy growth of well-paid jobs--could be expected for American citizens.

The following sections consider, first, options to foster a supportive environment for technology development and adoption. Next are options to carry out a comprehensive competitiveness policy in two areas: trade policy attuned to competitiveness needs and government-industry partnerships. Many of these options could be considered on their own merits, whether or not a more comprehensive policy is adopted. Last, there are options for new or altered institutions that would be needed to plan and implement a strategic competitiveness policy.

A TECHNOLOGY-FRIENDLY ENVIRONMENT

OTA's earlier report, *Making Things Better: Competing in Manufacturing,* **found that U.S. manufacturers have lost out in one industry after another to competitors who are able to make things better—to produce quality products at lower cost. And the key to this better performance is technology. Defined broadly, technology includes not only new products and advanced production machinery but also efficient organization of work and effective use of people.**

Industry and government both have roles in building a better technology base for U.S. manufacturing. The report delineated four areas in which government could contribute:

- **Improving the financial environment for U.S. firms, by taking action to reduce capital costs and relieve other pressures in the financial markets to show high profits every quarter. Focus on short-term profits at the expense of longer term investments in advanced equipment and new technologies has hobbled U.S. competitiveness.**
- **Upgrading education and training of the managers, engineers, technicians and workers needed in manufacturing. U.S. manufacturing suffers not only from the well-known defects in American public education but also from failures by managers to train workers and organize work to make best use of workers' abilities. Beyond improving public education, government can also help in the training of workers and managers and the education of manufacturing engineers.**
- **Diffusing technologies throughout the manufacturing sector. Many companies, especially small ones, are slow to take advantage of modern production equipment and manufacturing processes. Government technology extension services in several States and foreign countries have shown they help manufacturers select and learn to use up-to-date technologies. Other devices for technology diffusion might include a government-subsidized equipment leasing system, or easier access to technologies developed in government labs.**
- **Forming a strategic technology policy to promote the development of new technologies with commercial promise through collaborative ventures with industry.**

Several of the options outlined above would benefit all American manufacturing, with no distinctions in kind. A hospitable environment for the generation and adoption of new technologies throughout manufacturing is needed regardless of more targeted efforts to nurture particular technologies or industries. The option for a strategic technology policy is one of those more targeted efforts, and is discussed in a later section. The discussion immediately below covers the more general options to lift the performance of U.S. manufacturing as a wholes

The Financial Environment

America's financial climate is not hospitable to long-term investments in new technology and production equipment. High U.S. capital costs favor short-term profits over long-term investments, as do pressures from the stock market. Recent studies provide solid evidence that U.S. capital costs have been substantially higher than those of Japan and Germany for more than a decade, through 1988.[6]

Capital costs are influenced by interest rates, the economic depreciation of investment and its tax treatment, and other fiscal incentives for investment. In the United States, government policy has contributed to high interest rates, particularly in recent years. The combination of high Federal budget deficits and low personal and business savings rates has kept a relentless upward pressure on interest rates. Congress and the Administration agreed on some genuine budget discipline in late 1990, but the 1991 deficit was still projected to climb to an all-time high (declines over the next 4 years were also projected).

The dilemma is that some specific fiscal measures that might help firms to modernize and invest in new technologies would also tend to worsen the budget deficit, because they involve raising tax expenditures or lowering revenues. The budget agreement of 1990 forbids this, unless there is a compensating rise in tax revenues or decline in spending elsewhere in the same part of the budget (domestic non-defense programs).[7] **The serious efforts in the budget agreement to curb the deficit make sense from the standpoint of improving competitiveness since, otherwise, additional measures to reduce capital costs would probably have no more than a marginal effect. If Congress wishes to lower capital costs**

through tax breaks, the difficulty will be to find something else to cut in the nondefense budget, or get agreement to raise other taxes in compensation. Eventually, economic growth based on stronger competitive performance could help to ease the budget problems, but in the short run there would be a price to pay.

Increased savings could help to ease the upward pressure on interest rates and thus lower capital costs. A combination of carrots, sticks, and appeals to patriotism might induce greater savings. Congress could consider inaugurating a national savings campaign that rewards regular savings. For carrots, one option would be to offer government bonds at an attractive, guaranteed interest rate to people who sign up for a regular program, such as a payroll savings plan. Another option might be a tax reduction on the interest income from payroll savings.

The sticks would be policies to discourage consumption. One option is a consumption tax, crafted to escape the severe regressive effects of a flat tax either by taxing necessities lightly (or not at all) and luxury items heavily, or by granting substantial exemptions. A consumption tax might serve the dual purpose of encouraging savings while raising tax revenues. Another option would be to limit tax deductions for interest on home mortgages more strictly than the law already does. Although home equity is a form of savings for householders, these savings are tied up and unavailable for capital investments in manufacturing industries.

Tax breaks could help to lower the cost of capital to industry even if interest rates remain high. Congress could consider several options for tax inducements for technology development and capital investment. The United States has a long, but inconsistent, history of offering investment tax credits and accelerated depreciation to promote capital investment. There is evidence that these measures do have positive effects, though the magnitude is a matter of debate. They would undoubtedly be expensive; they cost tens of billions of dollars a year in lost tax revenues when they were in force.[8] The tax credit for R&D is far less expensive (amounting to hundreds of millions in forgone revenue per year) but it also has less effect on competitiveness; while it rewards technology development, it has little effect on the actual adoption of new technologies in manufacturing practice. As with the investment tax credit, it is hard to pin down how much extra R&D is due to the tax credit. Yet despite the uncertain payoffs, the arguments in favor of both kinds of programs are substantial enough that they deserve a careful hearing. It is worth repeating that under the current budget agreement (lasting through fiscal year 1994) such measures cannot be adopted unless the revenue losses they entail can be made up in some other way.

Incentives to hold investments longer might take some of the pressure off managers to focus on short-term profits. One option would be to create a capital gains tax that favors long-term gains and penalizes short-term turnover of holdings. A variable rate scheme might be adopted, with a high tax rate (say, 50 percent) for gains on assets held less than 1 year, and the rate declining through several steps to a low level (perhaps 10 or 15 percent) after 5 or 6 years. The measure would be most effective if its application were extended to pension and other funds that are now tax-free, since these funds hold one-third of the stock and probably account more than half of the transactions on the capital markets.

Stability in the economic and political environment is a great asset to business, and has been well provided in Japan and Germany, much more so than in the United States. Germany has successfully concentrated on keeping prices and exchange rates stable. In Japan, business has benefited not only from long-sustained economic growth and low inflation but also from policymakers' sensitivity to the effects on business of macroeconomic changes. For example, in the mid-1980s when the yen suddenly rose greatly against other currencies, the Japanese Government made low-interest loans easily available to firms (especially small ones) so they could ride out the period of adjustment. American manufacturers penalized by the very high value of the dollar in the early 1980s got no such help.

Human Resources

Success in manufacturing depends on having well-trained people, comfortable with the demands of advanced technology, at every level from the manager's office to the shop floor. In frost class competitive industries, production workers must sharpen reading and math skills, take more responsibility, cooperate more closely with others, and understand their own roles in the entire production system. In other words, more is being demanded of workers. At the same time, the typical American

education leaves many young people ill-prepared for work, and training of the people already in the work force is equally deficient. Our major trade competitors (i.e., Japan and Germany) offer more and better training, both to young people preparing for work life and to active workers. The situation in the United States is likely to get worse before it gets better. About half the new entrants to the U.S. work force up to the year 2000 will be members of minority groups, and two out of five minority children grow up in poverty. Poor children drop out of school disproportionately and many never learn the skills they need for productive work.

A great deal of public policy attention is being given to the critical need for improved public schooling. But even if help arrived tomorrow, it would be many years before the results showed up in the work place. Meanwhile, another approach is government-industry programs to offer better training to those already in the work force. This would include not only financial commitments from both government and industry but also a management style that gives workers a real stake in the enterprise and real responsibilities for quality and efficiency, and organizes work to take advantage of workers' training and abilities. Some of the options for training active members of the work force are as follows:[9]

Government encouragement to industry to train workers encompasses several possibilities. The most aggressive and far-reaching of these options, which guarantees more training without any direct cost to the government, is a payroll-based training levy. Employers would have a choice between spending a certain amount on training their workers (say 1 percent of their payroll) or paying the same amount into a national training fund. Several foreign countries (including France, Germany, Ireland, and South Korea) use the system, and four States in the United States (California, Delaware, Rhode Island, and Alaska) raise training funds through a small payroll-based levy. A less pervasive option is government technical assistance to help trade associations or joint labor-management groups identify industry-wide training needs and acquaint their members with training materials and best practice approaches. U.S. trade associations are far less active in training than their European counterparts, yet it is a low-cost way of wholesaling training information to individual firms. Cost-sharing by governments could get the activity started. A similar option is for the government to offer small grants to help firms set up training consortia. Small companies could share the costs of instruction and facilities, and large ones could use consortia to help their supplier networks develop common training appreaches.[10]

Training delivered to individual workers includes several existing government-funded programs that need either revitalizing or more financial support to fulfill their promise. Apprenticeship can also bean excellent way for workers to get real skills training with recognized credentials. The American apprenticeship system once served industry and a small segment of the work force well, but fell into decline in the 1980s with cuts in funding and staff for the Labor Department's Bureau of Apprenticeship and Training, and shrunken support from industry. The Federal vocational education program has many excellent features including school-to-work programs, cooperative business-labor-education training programs for active employees, and some support for apprenticeships. The problem is finding enough money to support these programs in a meaningful way. For example, a demonstration workplace literacy program has generated keen interest with hundreds of application, far more than the program could accommodate.

Training linked with technology assistance is an effective combination. Many U.S. manufacturing fins, especially small ones, have trouble adopting new technologies. One source of the trouble is inadequate training. The United States is far behind many other countries in helping individual firms learn about and use new technologies, but some States and a small Federal program are making efforts in this direction (as discussed more fully below). The best of these programs integrate training into their industrial extension efforts. The National Institute of Standards and Technology (NIST) in the Commerce Department is the agency mainly responsible for the Federal Government's modest efforts in technology diffusion. It could link training with technology in its own programs and those of other Federal agencies, and could also serve as an information clearinghouse for State agencies trying to do the same thing.

Improving the quality of worker training is, in part, a Federal responsibility. The military is the largest training institution in the United States. Besides using conventional classroom and on-the-

job training, the armed forces have developed instructional technologies that might be adapted and transferred to civilian use. Although the law calls on the Department of Education to take on this task, no funds have been provided for it. The Department and other Federal agencies might also take a more active hand in testing and evaluating workplace training, with particular attention to computer-aided training technologies.

Education and training of engineers is a central issue for competitiveness. Although there seem to be plenty of engineers now (the United States has about as many engineers per thousand workers as Germany and Japan), the supply could dwindle a few years hence because of the demographic facts. The group most inclined to enter engineering, white males, is shrinking as a proportion of children in the educational pipeline. In the long run, an adequate supply of engineers depends on our success in giving all our children a good education, including better math and science education starting in the early grades. Meanwhile, Federal scholarships and grants that encourage minorities and women to take up science and engineering careers seem to be getting results and deserve support. Retraining of mid-career engineers is another way to enlarge the supply over the next few years, especially as many engineers are losing jobs in defense industries, with the cutback in military spending. With government support, retraining courses might be targeted to fit the needs of commercial manufacturing.

Problems of manufacturing are generally neglected in university engineering departments. The elitism of U.S. engineers and their remoteness from the shop floor are weaknesses of American manufacturing. While this is primarily an issue for managers, government might support education and research in manufacturing engineering. One option might be to create a Manufacturing Sciences Directorate in the National Science Foundation.

Technology Diffusion

U.S. institutions for diffusing new technologies throughout manufacturing are thin. Even large firms with sufficient resources often neglect to take what they could from outside the firm. Many of our 355,000 small and medium-sized manufacturing firms are worse off, with only scant and spotty exposure to new technologies. While some small fins, such as Silicon Valley startups, are at the technological forefront, a great many others find the effort to keep informed beyond their means. The part played in U.S. competitiveness by these bread-and-butter small manufacturing firms can be critical. Large auto companies, for example, must depend on their myriad suppliers to deliver well-made parts and components on time.

Both public and private means of diffusing technology are weak in the United States. It is uncommon for large U.S. manufacturers to lend technical assistance to their suppliers, something that is everyday practice in Japan. And there is little in this country to compare with the network of free, public technology extension services for small and medium-sized manufacturers that blankets Japan. Nor do we have anything like the apprenticeship system that trains more than half the young people in Germany and Sweden and produces a high level of skills in the work forcr--a key factor in diffusing new technologies throughout manufacturing in those countries.

Throughout the past decade, Congress has taken actions aimed at transferring advanced technologies from lab to factory, bringing small and medium-sized firms up to date in best practice manufacturing technologies, and removing legal barriers that might interfere with technology advance in manufacturing. Some of these actions are well along. Others have just begun.

Congress may wish to strengthen and expand some of the more promising existing programs and consider adding others. No one program, by itself, is likely to improve U.S. manufacturing performance dramatically or rapidly. Some may fail. But given time to prove themselves, several of these measures in combination could pay off in real contributions to competitiveness. [11]

Technology extension has the potential to improve the manufacturing performance of small and medium-sized American fins. Defining industrial extension as one-on-one technical advice given to individual fins, 16 States had real extension programs (including field agents) in early 1991, and another 7 had technology demonstration or assistance centers. At a rough guess, total spending for 27 extension or demonstration programs in 23 States amounted to about $50 million. Most of these programs are new, although a handful, such as Georgia Tech's Industrial Extension Service, have years of solid experience. Federal industrial exten-

sion is still smaller and newer. A program of Manufacturing Technology Centers was established in the 1988 Trade Act, and by 1991 included five centers, with another planned for 1992. Fiscal year 1991 funding was about $12 million, with nearly $14 million proposed for 1992. The Centers are required to get matching funds from the States or private sources and, by law, cannot receive Federal funds for more than 6 years. Because many States were in financial distress in 1991, interest in supporting new Centers had declined somewhat.[12]

For perspective, compare these few and scattered programs with those in Japan. Besides the nationwide system of 185 technology extension centers, funded at about $500 million (half from the national government and half from prefectures), many Japanese cities, wards, and other localities support industrial halls that offer similar services. In addition to individual technical advice from field agents, these services include regular workshops on common manufacturing problems, use of specialized or costly equipment at low fees, demonstrations of new technologies, and referrals to expert consultants for advice on difficult problems.

There is room for expansion of both State and Federal technology extension services in the United States. States, being closer to clients, may be more in touch with local needs. On the other hand, various kinds of manufacture tend to be regionally concentrated, and Federal agencies can more easily span State lines. Moreover, while some States do an excellent job of delivering services, some are less adept. A Federal effort could help to set an acceptable, consistent quality of service.

Supposing Congress wished to support a wider network of technology extension centers, it might set a rninimum goal of providing services in some 120 centers to 24,000 small and medium-sized firms nationwide per year-i. e., about 7 percent of the nation's 355,000 manufacturing firms with fewer than 500 employees. This would cost about $120 to $480 million per year, depending on the level of service. Some of the funds could come from State or private sources, though it may be unrealistic to demand that these sources take over all the funding within a few years (as Federal law now provides in the case of the Manufacturing Technology Centers).

A program of this size is modest and might be overwhelmed with requests for assistance once the centers gained a good reputation. The State of Georgia's highly regarded industrial extension service, run by Georgia-Tech, serves a similar proportion of its manufacturers; it does not advertise for fear of being swamped with requests. It is worth noting that the U.S. Agricultural Extension Service is funded at $1.2 billion per year (with about $370 million, or 30 percent, coming from the Federal Government), and has 9,650 county agents, 4,650 scientific and technical staff, and offices in nearly every county in 50 States. Agriculture accounts for 2 percent of the U.S. gross national product, manufacturing 19 percent.

Government financial aid tied to improvements in technology can be an effective means for modernizing manufacturing. It has not been much employed in the United States (except to induce investments in pollution control equipment), but has been widely and ingeniously used in Japan. One option with at least two distinct advantages is a system that would allow manufacturers to lease modern production equipment, or buy it on the installment plan, at subsidized rates. This scheme would not only encourage manufacturers to use up-to-date equipment, such as computer numerically controlled (CNC) machine tools; if the system bought U.S.-made equipment it could also benefit U.S. builders of the machinery by offering a stable, assured market for part of their output. An equipment leasing system for CNC machine tools, for example, could start with modest government funding, probably about $3 million per year.[13] It might be open only to small manufacturing fins, or could be open to all, with lower rates for small fins.

It is also possible to make government-backed financing to small manufacturing firms conditional on a technical assessment. However, that presupposes a nationwide, readily available industrial extension service, which does not yet exist in this country. Moreover; Federal programs of financial support for small business are not large enough to reach many fins. All the programs combined (including loans, loan guarantees, and investments in development corporations) amount to about $3.5 to $4 billion per year for every kind of small business, not just manufacturing fins. In Japan, the required technical assessment is common practice, and there it does matter. Although exact comparisons are not possible, we do know that Japanese loans and loan guarantees to small firms are at least 20 times greater than similar U.S. financial aid, and the level of subsidy is higher (some government loans for modernizing equipment are interest-free).

As of 1988, nearly 11 percent of all outstanding loans to Japanese small businesses for plant and equipment investment were from government financial institutions, a big enough chunk to make required technical assessments significant.[14]

Another option is tax incentives for investments in advanced manufacturing equipment. This is another of the many inducements the Japanese Government offers to businesses, especially small ones, to modernize. For example, Japanese tax law was changed in 1984 to allow very rapid depreciation by small firms of high-technology ("mechatronic") equipment, including CNC machine tools. This set off a flurry of buying known as the "NC-ization period."

Commercialization of technology from Federal laboratories is a goal that Congress has pursued for more than a decade through laws and oversight. There has been progress, especially in the last year, but the goal is not yet fully realized. The U.S. Government spends about $23 billion per year for R&D in Federal laboratories; only a minor portion of this is of commercial interest. Much of the labs' R&D is for advanced development of weapons, and a large share is for basic research quite far from the commercial arena. However, some lab results have proven useful to civilian industry, and companies have benefited from using specialized lab facilities (e.g., the Synchrotrons Light Source at Brookhaven National Laboratory and the Combustion Research Facility of Sandia National Laboratories). Two principal ways of bridging the gap between lab research and commercial manufacturing are: 1) granting firms some exclusive rights to inventions from the labs, so it is worthwhile to invest in commercializing the technologies; and, 2) creating cooperative R&D projects, in which industry puts up half the money and is involved in the planning from the beginning.

Two obstacles on the government side have been too little money and too much red tape. With other missions taking priority, lab funding of technology transfer has been scanty. Bureaucratic hoops in the parent agency, especially delays for legal review, have often stalled technology licensing and the conclusion of cooperative agreements between the labs and private industry for many months, sometimes a year.[15]

Congress has taken steps to cut the red tape and provide more funding for technology transfer from the labs. Since the passage of the National Competitiveness and Technology Transfer Act of 1989, technology commercialization has received more attention at the Department of Energy (DOE) and its labs. The high-level Technology Transfer Project Group has focused on streamlining approvals for both licensing and cooperative R&D. Moreover, DOE has extended to some labs more control over patents and data rights from lab research, permitting a faster track to licensing technologies with commercial appeal.[16] For its part, industry has become more aggressive at seeking out lab technology .17

The heightened "attention to commercialization has yielded some results. Cooperative R&D has increased.[18] But despite the progress, funding is still limited. DOE's Defense Programs devoted only $20 million, or 0.7 percent of its $3 billion fiscal year 1991 R&D budget for technology transfer. Sandia National Laboratories' direct spending on technology transfer does not exceed 0.5 percent, or $5 million, of its $1 billion budget, and many other labs have earmarked less or nothing at a11.[19] Congress might consider designating some of the labs' R&D appropriation for promoting commercialization, perhaps mandating that a few percent of the budget be set aside for the purpose. Activities would include identification and marketing of promising technologies, patenting when appropriate, and participating in cooperative R&D projects. Bills being drafted for the 102d Congress would increase the labs' role in promoting technology commercialization.[20]

In addition, Congress could take action to remove some remaining barriers to commercialization. For example, the law might be changed so that software created by government employees can be copyrighted, which would sometimes make its commercialization more feasible.[21] At some point, however, major responsibility for energetic technology transfer must fall to the labs, their parent agencies (especially DOE and the Department of Defense), and private companies.

Japanese technology is another lode that U.S. companies could mine if they begin to pursue new technologies from outside sources more aggressively. There are difficulties-the most obvious being the language barrier-in getting access to Japanese technologies. Also, most Japanese technology is developed by private industry and thus is less accessible to outsiders than technical knowledge

that is freely available at universities and public institutions.

A few universities have fellowship programs that send American scientists and engineers to Japanese companies and research institutions on long-term projects, and the National Science Foundation (NSF) has recently established similar programs, largely funded by grants from the Japanese Government. The NSF-Japan programs are not yet fully subscribed, but are likely to attract more applicants as they become better known (typical of university programs). Congress may wish to monitor the progress of the NSF programs, possibly adding funding if they become oversubscribed. Another option would be to establish a congressional U. S.-Japanese Fellowship Program, taking advantage of the visibility and prestige conferred by the sponsorship of Congress (perhaps especially in Japanese eyes). In addition, Congress might wish to encourage sabbaticals in Japan for researchers working in Federal labs. A longer term, more fundamental option is to promote Japanese language instruction both in the public schools and in universities, especially for scientists and engineers.

Improved protection of intellectual property and modest changes in antitrust law might bolster the competitive position of some U.S. manufacturing industries. Better intellectual property protection could start at home with speedier enforcement. Patent cases that go to trial take an average of 21/2 years before a decision. Congress might help by designating special patent judges with the technical experience to move cases through expeditiously (similar in principle to the tax courts). As for foreign markets, the Japanese patent system is a particular problem. It is slower than the U.S. system in issuing and enforcing patents, and it strongly favors licensing of patents, which U.S. companies do not always wish to do. The U.S. Government is negotiating with the Japanese on these and other problems. In addition, Congress may wish to establish a program in the Patent Office or elsewhere in the Commerce Department to provide information to U.S. companies about the Japanese patent system, which most firms do not understand.

Antitrust law and enforcement have been relaxed in the past decade, but some cooperative endeavors that could help U.S. firms may be dampened by fear of antitrust action. Changes in antitrust law and enforcement should be approached with caution; the laws have served the country well for many years in maintaining g competition. However, the laws' complexity and vagueness, together with stiff penalties, may discourage some useful cooperation. Congress amended the law in 1984[22] to make joint R&D easier, chiefly by reducing the maximum penalty from treble damages to single damages for publicly registered projects. Other options might include extending the 1984 Act to cover joint manufacturing (as proposed by the Administration in the 102d Congress), and case-by-case review and advance certification by the Justice Department that particular joint projects do not violate the law. Another possibility is to establish safe harbor market shares, so that cooperating firms with combined market shares below a certain percentage would not be in violation.

Perhaps most important, Congress could instruct the Justice Department and the courts to evaluate possible mergers and joint ventures in light of a key fact of modern international competition: that foreign firms with low U.S. market share may rapidly increase that share and even become dominant, if they possess strategic technology, large world market share, sufficient financing, or other advantages. If this fact is accepted, then under standard antitrust analysis mergers or joint ventures between U.S. firms should sometimes be permitted to avoid eventual dominance by a foreign firm. Similarly, some buyouts of U.S. firms by a foreign firm would sometimes be stopped, in order to avoid eventual dominance by the foreign firm. These arguments have often been met with skepticism; Congress could urge that they be taken seriously.

Information and exhortation to American manufacturers on how to make things better, given under U.S. Government auspices, might not seem a very promising strategy. But a Department of Commerce program (the Malcolm Baldrige National Quality Award) does that very thing, and has proven astonishingly effective in just 3 years. It costs the taxpayers almost nothing. Even the administrative expenses are covered by private contributions and applications fees from companies vying for the award.

The award was created by Congress in 1987. It is given to companies or organizations that have "substantially benefited the economic and social well-being of the United States through improvements in the quality of their goods or services from

Box 2-A—The Baldrige National Quality Award

The manager of the Baldrige Award, the National Institute of Standards and Technology (NIST) of the U.S. Department of Commerce, sets out seven major criteria that contestants must address in their applications for the award. NIST's Application Guidelines list the maximum points applicants can win in each of the categories, adding to a total potential score of 1,000 points.[1]

Leadership: The senior executives' success in creating and sustaining a quality culture. 100 points.

Information and Analysis: The effectiveness of the company's collection and analysis of information for quality improvement and planning. 70 points.

Planning: The effectiveness of integration of quality requirements into the company's business plans. 60 points.

Human Resource Utilization: The success of the company's efforts to utilize the full potential of the work force for quality. 150 points.

Quality Assurance: The effectiveness of the company's systems for assuring quality control of all operations. 140 points.

Quality Assurance Results: The company's results in quality achievement and quality improvement, demonstrated through quantitative measures. 180 points.

Customer Satisfaction: The effectiveness of the company's systems to determine customer requirements and demonstrated success in meeting them. 300 points.

Every year, six awards may be given, two each in three categories, Manufacturing, Service, and Small Business. Awards need not be given if no one qualifies. The winners are shown in the table below.

Winners of the Baldrige Award

	Manufacturing	Service	Small business
1988	Motorola, Inc. Commercial Nuclear Fuel Division, Westinghouse Electric Corp.		Globe Metallurgical
1989	Milliken & Co. Xerox Corp., Business Products & Systems		
1990	Cadillac Motor Car Division IBM Rochester	Federal Express	Wallace Co., Inc.

[1] *Iu.s.* Department of Commerce, National Institute of Standards and Technology, *Malcolm Baldrige National Quality Award*, pamphlet (Gaithersburg, MD: NIST, 1991).

effective practice of quality management. "[23] Six awards may be presented each yeat--two each for manufacturing, services, and small business-but none need be given if no one qualifies. In the first 3 years of the program (1988-90), there were 203 applications and 9 awards given, 6 to manufacturing companies, 2 to small business, and 1 to a service company (see box 2-A).

The award has been an excellent means of technology diffusion. Just filling out an application, following NIST's 42-page booklet of Application Guidelines, can be an eye-opener. For example, the company must satisfactorily relate how it gives customers easy access to assistance or opportunities to comment, and how it follows up with customers to see if they are satisfied with products and services. These are just 2 of 33 detailed areas that companies must cover in their applications (50 pages for small companies, 75 pages for large ones). According to Jerry Junkins, CEO of Texas Instruments, "If you measure your-self against the criteria laid out by the Baldrige award, you have a blueprint for a better company. [24] All applicants, win or lose, receive reports from examiners outlining their good and bad points, and this is enough to improve some companies' quality efforts. Some companies do not enter but use the Baldrige criteria as a company standard. One winner, Motorola, demanded that 3,600 of its

larger suppliers prepare to compete or face being dropped.[25]

Winners must share with others details of what they did to win the award; company representatives give hundreds of speeches a year and hold large briefing sessions for executives of other companies, including their competitors. One manager who attended a winner's presentation came away amazed at the level of detail, which he described as "everything but the financial data." After hearing the presentation, he reckoned that his own company, considered a leader in its high-technology field, would not be able to qualify for the award for at least 6 years.

Despite a few criticisms of the Baldrige award (e.g., some consultants consider the criteria are too directive), its good effects appear to far outweigh any adverse ones. In the general area of quality standards, however, there may be room for further government action. Suppliers trying to meet formal quality requirements for large customer fins, particularly the Big Three auto assemblers, are frustrated by slightly varying requirements and separate certification. If Ford's Q-1 and GM's Mark of Excellence certifications were made consistent and interchangeable, suppliers believe they would benefit. Through oversight, Congress might encourage NIST to look into the question and work out a constructive solution.

TRADE POLICY TOOLS

Since World War II, U.S. policy has promoted free trade by keeping its own market generally open and urging other countries to do the same. For two or three decades this policy served U.S. interests well enough. U.S. manufacturing technology was so far ahead of most other countries, and the U.S. market so much larger than others, that manufacturers flourished even in cases where the free trade was mostly one way—free for U.S. imports but quite encumbered for exports. At the same time, opening American markets to foreign goods served the U.S. policy of promoting economic development in poorer countries and cementing loyalty among Cold War allies.

Today, free trade is not invariably to the United States' advantage. Advanced countries have rebuilt their war-damaged economies, several poorer countries have begun to industrialize, and the United States is no longer predominant. In some industries and technologies it has fallen to second place. This is a particular concern in key high-reward industries such as electronics, including parts of the semiconductor and computer industries. These are industries that can help make a country rich, because markets are rapidly expanding, producers can capture substantial economies of scale and learning, and the industry has technology spillover benefits for the rest of the economy.

Most of the United States' decline was self-inflicted. The U.S. Government has never formed the partnerships with industry that helped its best competitors advance. Many of its industries have stuck with outmoded management and technologies while others passed them by. Part of the trouble, however, was that foreign market barriers and export drives deprived key U.S. industries of needed revenues and experience, sapping their strength and even undermining their existence. The near-destruction of the U.S. consumer electronics industry was caused partly by closed foreign markets combined with dumping (selling at prices below fair value) of foreign goods in the U.S. market.

U.S. trade law and policy are supposed to prevent events like these. If foreign markets are closed to U.S. goods, the U.S. Government tries to get the barriers removed. If imports are subsidized by foreign governments, or if foreign subsidies or market barriers result in dumping, the U.S. Government can in some circumstances levy a duty on the imports intended to compensate for the foreign advantage. However, foreign market barriers may take years to remove. U.S. law regarding subsidies and dumping has been at best slow and incomplete in compensating for the advantages foreign firms receive from their governments. Moreover, tariffs are inherently inadequate to compensate for another country's domestic policies; when foreign governments help to give their industries a competitive edge, it takes more than trade policy for U.S. industries to catch up.

U.S. trade policy could more effectively promote U.S. competitiveness if it were part of an overall strategy. A redirected trade policy might have three operating principles. First, when a critical industry is in trouble, the primary government response would be a domestic one. Measures might include R&D support, tax breaks and incentives for R&D & capital investment, support for technology diffusion, and support for education and training. Trade

measures-trying to open foreign markets, and protecting the U.S. market--could be used when necessary, but in a subordinate role. Second, efforts to open markets would focus on areas of the greatest strategic importance. Third, when opting to use protection, the basis would not be legalistic criteria, but rather the industry's need and place in the economy.

The important industries are not difficult to identify. Several government and private reports in the United States, Japan, and Europe have listed high-priority technologies that drive competitive industrial performance, and their lists are similar. They include electronic components, information technologies, materials and associated processing, manufacturing process technologies, and propulsion and powertrain technologies.[26] Ideally, the important industries would be identified by an institution responsible for a comprehensive government approach to trade and competitiveness policy. Otherwise, individual government agencies involved could draw up their own lists.

This leaves the question of how to fashion assistance to threatened U.S. industries. There is the danger that government assistance will be squandered on industries unable to compete, or that assistance will remove industries' incentive to improve their competitiveness. However, other countries' experiences provide significant guideposts—showing, for example, that industry should take the lead in proposing joint government-industry R&D programs and shoulder much of the cost; that policies should conform with market forces as much as possible; that U.S. industry must compete with the best in the world; and that industry must make its own efforts to improve its competitiveness and outgrow the need for assistance. Ideally, a government institution with overall responsibility for trade and competitiveness would coordinate strategic assistance. But in the absence of such an institution, individual agencies could act on their own according to these principles. For example, the Department of Energy, in its pilot program for cost-shared R&Din high-temperature superconductivity, participates only in projects that industry proposes and for which industry pays about half the cost.[27]

Finally, these options come with an important caveat. This report is addressed to Congress, and presents options that Congress may wish to adopt. Yet there is little that Congress can do on its own. It can state goals, allocate resources, and give guidelines, but strategic policies to improve U.S. competitiveness policies require initiative and judgment by the executive branch. The sympathies and energy of the executive branch are needed to get the job done.

Responses to Foreign Market Barriers

Foreign market barriers can hurt U.S. industries.[28] While GATT has reduced quotas (quantitative restrictions on imports) and tariffs (taxes on imports, also called duties), there are many other barriers to imports. These include burdensome customs procedures; preferential government procurement; discriminatory standards and regulations; and companies' agreements or practices, sometimes tolerated or encouraged by the government, not to buy foreign products.

Normally, the U.S. response, if any, is to negotiate to eliminate barriers. The Office of the United States Trade Representative (USTR) leads the negotiations, with assistance from other agencies. The USTR's lean staff can negotiate only a limited number of cases, and may be so overburdened as to affect the quality of negotiations. And the fast turnover of many senior (political level) negotiators and policymakers has sometimes hindered the United States from pressing its position consistently over the years. High ranking government officials have frequently left government to represent foreign manufacturers or their U.S. importers, giving those interests both access to top government decisionmakers and the savvy to exploit any weaknesses on the U.S. side.

Congress could address these problems in various ways. It could expand the USTR staff, enabling it to take on a wider range of foreign market barriers and match other nations, Japan in particular, in preparation and negotiating strength. Congress could also reduce the number of political appointments and add more high-level career civil service slots dealing with trade policy to the USTR, the Commerce Department, and other agencies; making long-term service more attractive would improve institutional memory and facilitate the steady pursuit of goals over the years. Finally, Congress could prohibit senior trade officials from representing foreign interests for several years after they leave government service.

Other reasons why foreign markets can take many years to open are harder to address. Barriers take

time to identify; other countries can stall negotiations; countries hedge on promises to remove barriers; and when one barrier is removed, another can take its place. Japanese trade barriers especially are often like an onion, with layer after layer to peel away. And some hindrances are ingrained in a country's social norms and domestic policy, making their removal difficult even if the foreign government is willing.

Success often depends on the leverage the United States has over other countries. The two major sources of leverage are limited. First, when the country and subject matter are covered by GATT, the United States can invoke GATT dispute resolution procedures. This process is slow and uncertain, since the other country can veto decisions adverse to its interests. Recent developments in the GATT Uruguay Round have improved the process; further improvements may yield a more reliable means for eliminating market barriers.

Another approach would be to create a new, multilateral trading system, consisting of only those countries that are truly willing to abide by the dictates of free and open trade, and to negotiate bilateral deals with nations outside the system.[29] This kind of trade management far exceeds anything we have done in the postwar period, and creating it would require much time and patience. The new trade regime probably would need a strong enforcement mechanism, perhaps along the lines of the International Trade Organization (ITO), which was originally proposed in the late 1940s but was blocked by the United States and therefore never formed.[30] Congress might wish to forma task force to investigate what such a revised system could entail.

The second source of leverage is to threaten retaliation under Section 301 and related sections of the Trade Act of 1974, as amended,[31] which allow the United States to impose punitive barriers to imports from another country in retaliation for that country's "unfair" trade practices. However, the U.S. Government is often reluctant to retaliate under Section 301. The retaliation could violate GATT so publicly as to make the United States vulnerable to criticism (including formal complaint and investigation under GATT rules) or further retaliation. Punitive barriers on imports would not solve the U.S. industry's problem and could create problems for downstream industries in the United States. And even the start of a Section 301 investigation angers foreign countries, for whom Section 301 is a symbol that the United States considers its national laws superior to GATT's international law.[32]

Because of these problems, negotiations to open foreign markets are in many cases slow and ineffective. Barriers that cause particular damage--such as Japanese barriers to the sale of semiconductors and supercomputers (chs. 4 and 6)--often persist the longest. While market opening is a worthwhile long-term goal, it often provides little or no relief in the short term, during which time the affected U.S. industry can suffer serious damage.

Accordingly, it might make sense to change the U.S. response to foreign market barriers. The response could be primarily domestic programs to aid the affected industry. Often these programs would be enough. The U.S. market, still the world's largest for many products, can often support the industry. In such cases, the United States could still negotiate to open foreign markets, but in a low-key manner, to encourage change without angering the countries involved. It would also make sense to allocate the government's limited resources according to an industry's strategic importance.

However, domestic programs might not always be enough. This might be the case with semiconductors. Even though the U.S. Government is contributing $500 million in R&D assistance to the industry over 5 years through Sematech, that is insufficient to arrest the U.S. industry's competitive decline vis-à-vis Japan. The semiconductor industry is particularly dependent on economies of scale and learning, and without access to the Japanese market—the largest and most discriminating in the world—the U.S. semiconductor industry will likely keep slipping.

In such a situation-a key industry in danger if a foreign market remains closed—the United States could consider an aggressive program to open the foreign market, if necessary by a prompt threat of retaliation under Section 301. These cases could merit cabinet level or even Presidential involvement. Semiconductors apparently is a case in which aggressive action was deferred for too long. Despite negotiations begun in 1972, Japan's semiconductor market remained largely closed to U.S. products.[33] The United States commenced a Section 301 investigation only in 1985, leading to an agreement in 1986 that was broken by Japan, followed by U.S. retalia-

tion in 1987, and finally, starting in 1989, a modest increase in U.S. firms' share of the Japanese market.

While it might occasionally make sense for the United States to pull out all the stops in trying to open a foreign market, such cases must be chosen carefully. As discussed above and in chapter 4, the threat of retaliation-and execution of this threat—is likely to anger foreign countries and could have other serious adverse consequences. It is thus important to rank foreign market barriers, identifying those industries that are most important and in which barriers have a pronounced effect that domestic programs cannot alleviate. In general, the USTR has not made strategic priorities. For example, in the early 1980s, the U.S. Government successfully pressured Japan to buy a certain amount of U.S.-caught fish, but would not do the same with semiconductors.[34] This lack of strategic planning was evident and surprising to Japan. Clyde Prestowitz, a key Japan negotiator in the Commerce Department for most of the 1980s, recalls: "Once an official of the [Japan] Economic Planning Agency asked how we created our agendas. His agency, he said, had carefully studied the competitiveness of various U.S. industries, and in his opinion there were much better issues for the U.S. to pursue than the ones on its list. "[35]

Use of Protection

U.S. industries normally receive trade protection only when imports are dumped or subsidized.[36] In this case, an extra duty can be assessed in an amount that in theory will precisely counteract the subsidy or dumping. In principle, this extra duty does not distort trade from what would occur with free trade and a free market, but rather corrects a distortion already present. The goal is to put U.S. industry back on an equal footing. Such extra duties are in principle consistent with GATT.

However, the U.S. law and practice regarding subsidies and dumping by and large fail to compensate for the advantages foreign governments create for their firms. Reasons for this include delay, difficulty in proving subsidies or dumping, the law's ignoring or devaluing certain subsidies, difficulty in proving the required injury, and the high expense of legal proceedings. A further problem is that the effects of government assistance can increase over time rather than dissipate as the law assumes. To some extent, the law's limited effectiveness stems from adherence to GATT requirements.

These U.S. laws, however imperfect, are now often the only line of defense for key industries facing stiff foreign competition; it could be harmful to weaken them further as many GATT members are seeking to do in the Uruguay Round. However, strengthening these laws might lead to a flood of cases, anger trading partners, provoke legal challenges under GATT, and result in imposing extra duties that might not be in the country's best interest.

The debate between those who would strengthen and those who would weaken the subsidy and dumping laws might be resolved by shifting the policy focus of import protection. First, for beleaguered U.S. industries, the primary response would be *domestic programs* to help the industry compete or rationalize. (To rationalize means to shrink, but in a planned fashion that also seeks to improve technology in potentially competitive subsectors.) This could include R&D support, tax breaks, and other measures designed either to help an industry regain technical parity with foreign competitors or to ameliorate the shock of downsizing.

Where domestic measures alone might not suffice, protection could be used, lasting only as long as strictly necessary. Criteria for awarding protection would include the industry's need, its merit (including whether the industry was making reasonable efforts on its own and showed promise of effectively competing on its own), and the importance of the industry in the U.S. economy. While the presence of subsidies or dumping might be relevant to the decision to grant relief from imports-for example, to show that an industry is being beaten only because of the intervention of foreign governments—subsidies or dumping would be among many factors to consider. Likely adverse effects on downstream industries would also be considered, though the government could take measures to ameliorate them (e.g., special tax breaks).

The protection component of such a reoriented policy in principle could be consistent with GATT. Such an approach could build on Section 201 and the following sections of the Trade Act of 1974, as amended, under which the government can impose temporary relief (up to 8 years) when increased imports "cause or threaten serious injury" to an existing U.S. industry .37 Section 201 follows GATT's so-called "escape clause, ' which permits import

barriers in this situation but requires the payment of compensation (normally reduced tariffs on other items) to affected countries (see ch. 4). Under Section 201, the U.S. International Trade Commission (ITC) determines whether the injury requirement is satisfied and, if so, recommends relief. The final decision on relief is up to the President, who has great flexibility in choosing the nature of relief. Forms of relief include quotas, higher tariff rates, and negotiations with foreign governments "to address the underlying cause of the increase in imports or to otherwise alleviate the injury."[38] The President must consider the efforts that the domestic industry is making on its own to improve its performance; every 2 years thereafter, while the protection lasts, ITC must report to the President on industry's continuing efforts to improve, and the President may modify or terminate relief if he finds those efforts insufficient.

However, as currently administered, Section 201 would have limited usefulness as a vehicle for strategic use of protection. The serious injury requirement is hard to satisfy, and partly for that reason Section 201 has been little used in recent years.[39] The law contains the requirement, not specified by GATT, that the increased imports be at least as great a cause of injury as any other cause.[40] The injury requirement is not often satisfied before serious damage is done. While the threat of serious injury is in principle enough to satisfy the statute, the threatened injury must be imminent, and a sufficient threat is rarely found. Also, following the language of GATT's escape clause, Section 201 by its terms can be used to protect industries already producing goods, not those still forming.[41]

Congress could make Section 201 more serviceable by eliminating the requirement that the increased imports be at least as great a cause of injury as any other cause. Congress could also specify that the injury test can be satisfied even when an industry is doing well, if the imports have impeded the industry's development or import and industry trends point to eventual foreign dominance. Such a provision might be consistent with GATT, although other countries could argue otherwise.[42]

GATT's escape clause requires that the increased imports and consequent injury be due to "unforeseen developments.' "[43] Section 201 does not. However, if the United States attempted to use Section 201 to protect a new (infant) industry struggling to compete against a well-established foreign industry, foreign countries could complain that imports and the consequent injury to U.S. companies were hardly "unforeseen. Uruguay Round negotiations might eliminate this requirement, which has rarely been used or invoked.

All told, Section 201 is far from an ideal tool for providing GATT-compatible protection. However, Congress could empower the President to grant protection apart from Section 201. Ideally, a government agency responsible for coordinating competitiveness strategies would recommended protection when needed. Instead of justifying protection under GATT's escape clause, the United States could justify it under GATT Article XXVIII. Under that Article, the United States could negotiate compensation, typically in the form of reduced tariffs on certain other products, in exchange for which other countries would accept increased U.S. tariffs on the products at issue. The President could be empowered to offer such compensation, as recommended by an agency with overall competitiveness responsibility. While compensation could adversely affect other U.S. industries, the government might, in some cases, be able to mitigate these effects with tax breaks or other programs that the same agency could recommend and the President could be empowered to grant, subject to a congressional override.[44]

If negotiations failed and other GATT-consistent means of protection could not be found, as a last resort the United States might impose protection anyway. Other countries have at times protected industries they consider crucial, regardless of GATT. Such a course might provoke a GATT dispute, and could possibly lead to a ruling requiring the United States to pay compensation.[45] This approach would not necessarily signal U.S. abandonment of its loyalty to GATT and the free trade ideals it represents. Rather, it would mean that the United States, like other countries, can depart from free trade ideals when necessary.

Under both Section 201 and this new approach, it would be desirable to condition protection on a performance requirement or showing of progress by the industry receiving protection (which has happened to some extent under Section 201). Open-ended trade protection with no strings attached has been a recipe for third-rate performance for industries in many countries (e.g., the national champion computer firms in Europe-see ch. 5). On the other

hand, the discipline Korea imposed on its developing industries+. g., requiring companies to succeed in exporting finished goods as a condition for permission to import production equipment, parts and materials-was an ingredient in the success of its export-led development, The specific policy tools Korea used are no model for the highly developed and much freer U.S. economy, but some kind of standard or gauge of serious effort on the part of the industry and progress toward competitive performance could be employed.

Domestic Content Requirements

The issue of domestic content is sure to come up if the United States protects industries against fair but damaging imports. One way of getting around protective tariffs and quotas is to build an assembly plant in the protected country; Japanese automobile production began in North America in large part to avoid current and prospective protection. The fact that foreign direct investment has grown faster than trade in the past couple of decades reflects, in part, companies' desires to avoid or avert national protection.

While foreign investment is often welcomed and occasionally sought, some nations have not been content to let foreign companies substitute domestically assembled merchandise for imported goods, because often the domestic assembly adds only a small proportion of value to what is basically an imported good. The United States has done little other than jawbone to increase the domestic content of foreign companies producing here, but many European nations and the European Community have moved more decisively. For example, the British Government eagerly pursued Japanese automobile investment but included the proviso that 60 percent of the content of the autos must be European at the time of startup and 80 percent within a few years. Such high levels of local content require that the body, the major mechanical components, and either the engine or the transmission be fully manufactured in Europe (see ch. 5); the current level is much greater than the local content of cars made by any Japanese transplant in North America, even after years of operation. Domestic content requirements are also prominent in Europe for electronics products, including office equipment, consumer electronics items, and semiconductors. Government procurement in most EC member nations strongly favors domestically made goods. Moreover, for nearly a decade, the EC has pursued vigorous antidumping measures against Japanese and other Asian firms selling electronics goods in Europe; the penalties can be lifted if the firms include substantial amounts of European-made parts and materials in their products, and many firms have relocated production to Europe in response.

Domestic content regulations, like tariffs and quotas, can benefit a nation. Almost certainly, they mean more jobs in the protected industry than otherwise, at least in the short run. But, like other forms of protection, they nearly always mean some short-term sacrifice by consumers in the form of higher prices. Whether national productivity or competitiveness improve with domestic content requirements is uncertain and may depend on whether they coincide with or are tied to measures to improve the competitiveness of the domestic firms or industries.

Experience with domestic content requirements in industrialized countries is recent and limited. There is some evidence that Japanese auto assembly transplants in North America have helped to improve the quality and productivity of U.S. suppliers; the more recent Japanese transplants in Europe are expected to do the same for European suppliers. Also, in North America the demonstration effect of the Japanese assemblers spurred the Big Three domestic automakers to improve their own and their suppliers' quality and productivity. It is not yet clear that requiring high domestic content of Japanese producers in electronics products will help the European electronics industry. It maybe improving the performance of some European suppliers, but if so that improvement has not yet spilled over into greater competitiveness of the European systems manufacturers who make computers, other office machines, and consumer electronics items; all these European companies are in trouble. It is also unclear to what degree good performance by Japanese-owned firms will contribute to an elevated level of technology and higher standards of living in the host country. It may be that the leading edge of innovation will remain in the home country of the foreign investor, but that the host country could still benefit from demonstration and direct teaching of superior manufacturing practice.

European policies reflect the ambiguities and uncertainties about benefits from foreign direct investment. The EC seems to have adopted a

principle of tolerating or encouraging foreign investment in some critical sectors *if* the foreign firm agrees to a high level of local content. Yet there are contradictions. The recent EC agreement with the Japanese Government on automobiles would allow only a gradual increase in the Japanese share of the EC market, both transplant production and imports, despite the high domestic content levels that the transplants have already agreed to and are trying to achieve (see ch. 6).[46] Overall, it seems that the EC Commission and the member governments are still trying to decide whether foreign direct investment is a net benefit.

Japan, on the other hand, has an unambiguous stand. Japan has often barred or severely constrained foreign direct investment, even when it was far behind other advanced industrial nations and trying to catch up. Even today, Japan remains one of the most difficult of industrialized nations in which to open a branch, partly because of the expense but also because of the red tape involved.

Export Promotion

Export promotion—helping firms take advantages of opportunities to sell abroad—is another policy tool that could help U.S. manufacturing competitiveness. To export, companies must pass many hurdles: analyzing foreign markets; identifying and contacting potential customers; learning foreign ways of doing business; creating new labels or otherwise adapting the product for foreign use; getting financing; and arranging for shipping, insurance, and customs clearance, to name a few. Even when a U.S. firm has a good, well-priced product, it can easily miss an export sale.

Government programs can provide information and contacts. They can inform U.S. firms about markets, potential customers, foreign regulations and procedures, shipping, and so on; they can inform foreign firms about U.S. firms and products; and they can arrange trade shows, interviews, and other contacts between U.S. and foreign fins. For manufactured goods, this assistance at the Federal level is provided primarily by the U.S. Foreign and Commercial Service (USFCS) of the Department of Commerce. (The Department of Agriculture provides export services for agricultural products.)

Government programs can also assist with export financing. Often credit terms play an important part in export sales, especially to developing countries. Government help in providing easier credit terms can take the forms of:

1. insuring the exporter against the customer's default, if the exporter allows the customer deferred payment;
2. guaranteeing a bank against the customer's default, if the bank lends the customer money for the purchase; and,
3. lending money itself, either directly to the customer or indirectly through a bank.

The Export-Import Bank of the United States (Eximbank), an independent agency of the U.S. Government, provides this kind of assistance.

In both information and financing, U.S. export promotion programs are weaker than those of our major competitors, primarily because much less is spent on them (ch. 4). The difference is due in part to limits on spending by the U.S. Government, after years of enormous budget deficits. It also stems from a fundamental uncertainty among U.S. policymakers as to whether export promotion is something the government should be doing.

If Congress and the Administration decide that export promotion is a legitimate government function, there are straightforward ways to make it more effective. Congress could increase funding for USFCS to pay for additional commercial officers posted abroad. These are the people who gather information about foreign market opportunities and help U.S. firms find foreign contacts. The summer 1991 level of about 200 foreign commercial officers,[47] while up somewhat from about 150 in 1980 and 1988,[48] is still low. For example," as of August 1990, there were only 15 commercial officers in Japan, plus 44 Japanese nationals assisting with export promotion, while 83 professional employees of the Japanese Government, all Japanese citizens, were working in the United States to promote exports.[49] Congress might wish to ask the Commerce Department whether other funding increases could provide improvements in service. In the late 1980s, budgets were very tight; sometimes USFCS officers even lacked funds to return phone calls to the United States. While funding has improved somewhat, given this history and the low level of spending compared to important trading partners, it is likely that additional funding could have a healthy payoff.

The level of service depends on attitude as well as money. Congress might wish to make a policy

statement that export promotion should be a priority not only for commercial officers abroad but for the whole diplomatic staff. Cabinet-level involvement in promotion activities, such as Commerce Secretary Mossbacher's presence in Tokyo in April 1991 to kickoff the Japan Corporate Program (ch. 4), could provide a boost.

Export promotion efforts could have a more strategic focus. While USFCS emphasizes industry sectors whose fundamental competitiveness suggests substantial export potential, it does not consider which industries are strategic to overall U.S. competitiveness. While Eximbank reports to Congress on the amount of financing meeting certain strategic priorities (such as industries with high value added, or industries that particularly benefit downstream industries), it is not clear how much Eximbank takes them into account in its decisions. Ideally, an agency with overall competitiveness responsibility would coordinate strategic priorities.

Strategic priorities for Eximbank could also help **to solve the problem of excessive paperwork.** Financing assistance by Eximbank must be justified on a case-by-case basis. Congress might consider adopting the approach used by Japan and many European countries, which determine in broad policy terms what exports to assist, and then assist all creditworthy exports within the guidelines.

U.S. manufacturers are at a disadvantage, compared with foreign competitors, because of tied aid. This is a scheme by which a country gives foreign aid on condition that the recipient use the money to buy products from the donor. The United States ties some of its aid, but U.S. nondefense aid focuses on agriculture, health, nutrition, and education. American farmers may reap large benefits, but manufacturers seldom do. Other countries concentrate aid much more on heavy construction projects, such as power generation and transportation, so that their tied aid involves manufactured goods, especially capital equipment.

Tied aid is often combined with export financing **in a package of so-called "mixed credits." For** example, the exporting country might offer to pay outright 40 percent of the cost of a power plant, and finance the other 60 percent, provided that national companies of the exporting country get the contracts for construction and equipment sales.

The U.S. effort to strengthen international agreements aimed at limiting tied aid are worth continuing. However, it is uncertain how successful that effort will be. Congress could expand the so-called War Chest for matching foreign tied aid offers to make it more effective in discouraging foreign tied aid. The War Chest was funded at $150 million in grants for FY 1991, which would result in about $500 million in loans, though as of July 1991 only $58 million in grants had been used, resulting in $131 million in loans. In contrast, Japan, France, and Germany use tied aid to make loans of billions of dollars per year.

Congress could also expand the Trade and Development Program (TDP), funded at $31 million for FY 1990 and $35 million for FY 1991. TDP helps to pay for feasibility studies or other planning assistance performed by. U.S. firms for capital projects. Participation in the planning phase has often helped U.S. firms win contracts for the actual project. So **far, $161 million in program funds have led to** documented U.S. sales totaling $3.2 billion, with an estimated $18 billion more sales expected as projects mature.[50] **In expanding TDP or otherwise** increasing the emphasis on capital projects,[51] care should be taken to avoid adverse environmental and social effects, which in the 1970s turned the United States away from such projects.

Export Controls

The export of dual-use items, those having both military and civilian use, is regulated by the Export Administration Act of 1979, as amended (EAA)~[2] which requires U.S. firms to get a license to export certain items to certain destinations. The intent is to deny strategically important goods and technology to potential military adversaries. In 1990, perhaps $90 billion worth of U.S. exports of manufactured goods required a license, or about 28 percent of the $316 billion in manufactured exports (see ch. 4).

It is generally agreed that some export controls on dual-use items are needed. However, there is an emerging consensus that export controls have unduly hindered U.S. high-technology firms in competition with foreign manufacturers. For example, U.S. controls limited exports of personal computers based on Intel's 80386 processor chip until mid-1990. Yet the same computers were widely available from foreign fins. The controls merely diverted business to foreign fins.

The U.S. export control regime has been considerably liberalized in the last few years. The political changes in Eastern Europe and the Soviet Union reduced those countries' military threat, lessening the need for controls, and in fact making desirable the export of technology to help those nations become open, economically viable societies. This changing political climate intensified the dissatisfaction of many allies with the United States' stricter position on export controls; allies brought pressure for change in the international export control regime. Finally, concern has increased over the continuing decline of U.S. manufacturing competitiveness, prompting closer scrutiny of whether the security benefits of particular controls are worth the competitiveness costs.

Reform has focused on East-West controls, traditionally the most common type, which are meant to deny militarily strategic technology to former Communist countries (see ch. 4 and box 4-C). Controls on many items have been removed or reduced, tracking a major reduction of controls at the international level, in CoCom (Coordinating Committee for Multilateral Export Controls, a group of nations cooperating in export controls). In principle, controls should be eliminated if they are not also imposed by other CoCom members, or if the item is available from unrestricted sources. In addition, delays in processing export license applications have been shortened.

However, the reform is incomplete. The reason is the tug of war that exists-and to some degree must exist-between two important governmental goals: military security, whose champion is the Department of Defense; and improved competitiveness, championed by the Department of Commerce. Although the competitiveness interest has received increasing support from the President and his closest associates, it still has not achieved equal consideration with military concerns. Congress cannot change this on its own: where possible damage to military security is at stake, the executive branch must exercise wide discretion.

If Congress were to create a new agency charged with promoting industrial competitiveness, many aspects of the export control function might reside there. It could coordinate export controls as the Commerce Department does now, but with a greater ability to serve the national interest. Other functions might include:

- evaluating the economic importance of different industries and the importance of exports to a given industry;
- expediting control reforms and license approvals in key industries;
- coordinating export policy with other policies (e.g., offering some compensating benefit to the affected industry when cumbersome export controls were deemed appropriate); and
- achieving enough prestige that its views on export control policy would carry equal weight to DoD's, within the Administration.

Without such an agency, and lacking a commitment in the Administration to advance commercial competitiveness, there are still measures that Congress could take if it wished to give competitiveness a higher priority in export control policy. However, the EAA is already a very complicated statute, and even some analysts sympathetic to competitiveness concerns believe that it contains excessive micromanagement. On the other hand, the statute leaves the the Administration an out to do what it believes is truly necessary in most cases. Where the statute leaves no flexibility, sometimes the Administration has disobeyed it. This occurred with the 1988 provision eliminating reexport controls on U.S. goods and technology that are incorporated abroad into finished products, provided the controlled U.S. content is at most 25 percent of the product's total value.[53] The Bureau of Export Administration (BXA) considered that provision dangerous; for example, it would remove controls from avionics equipment incorporated abroad into airplanes. BXA implemented this clause only incompletely and almost a year late (ch. 4).

Congress could strengthen the role of the Commerce Department vis-à-vis the Defense Department and other agencies. Congress moved in this direction in the Export Enhancement Act of 1988 (1988 Act),[54] for example, by limiting to 40 days the time during which the Defense Department can block a license approval recommended by the Secretary of Commerce.[55] Further amendments in this direction are under consideration in S. 320, already passed by the Senate.[56] For example, S. 320 would give the Commerce Department permanent representation at CoCom and direct the State Department to forward to CoCom within 7 days certain Commerce Department actions requiring CoCom approval.[57]

The Commerce Department has sometimes been bypassed when dual-use items have been put on the State Department's Munitions List, which is in principle limited to items with only military use. Items on the Munitions List face a stricter control regime, without the safeguards to protect commercial competitiveness that apply to dual-use items. Therefore, placing dual-use items on the Munitions List can reverse recent reforms and impede pending ones. Congress could discourage this practice by, for example, giving the Secretary of Commerce the right to force a quick Presidential decision regarding whether an item also has nonmilitary use. Congress could also issue a strong policy statement that the Munitions List is not to contain dual-use items.

Congress might enact additional provisions to address problems identified in chapter 4. For example, Congress could impose stricter time limits for processing license applications, especially those requiring interagency review; mandate prompt continuing review of the Control List (list of controlled items); encourage license-free trade within CoCom countries; encourage use of industry advisory committees; and encourage the use of indexing, by which technical thresholds of what is controlled would be automatically adjusted over time unless the need to forego the adjustment were specifically justified. The 1988 Act and S. 320 address these concerns.

Other provisions in S. 320 also address competitiveness concerns. This bill contains policy statements favoring approval of exports designated for reformed Eastern European countries, or needed to aid Soviet and Eastern European economic development. Another policy statement favors temporary exports for trade shows. However, these are by necessity only guidelines, leaving final discretion with the Administration. S. 320 provides for court review to force compliance with mandated deadlines, which have often been missed.[58] The EAA already provides for court suits to enforce statutory license processing deadlines;[59] this provision could be extended to cover other deadlines, such as for review of the Control List and for decontrol of items not multilaterally controlled. The review would be purely procedural; courts would not second-guess the substance of any decisions.[60]

There are swifter, more severe ways of enforcing deadlines. One approach is to make a missed deadline act as an acquiescence by the Administration. The 1988 Act did this for determinations of foreign availability requested by firms; if BXA missed the deadline, foreign availability would be assumed and the item decontrolled.[61] This provision was effective in speeding up those determinations. However, BXA reports that the provision strained its resources, and took effort away from other investigations of foreign availability that, while not requested, were perhaps more important to industry as a whole. BXA also states that that provision has the potential to force U.S. decontrol before it is authorized by CoCom, thereby undercutting the multilateral export control system that the United States is trying to strengthen. Another option is to make decontrol self-executing-that is, when decontrol is mandated by law (e.g., on items not controlled by other nations) the decontrol would take effect even if BXA has not published implementing regulations. Congress considered such a provision in 1990.[62] However, the absence of regulations could cause confusion, resulting in exports detrimental to national security.

One practical, nontechnical way to facilitate timely adjustment of controls would be to increase the staffing in the Commerce Department's Office of Foreign Availability (OFA). OFA determines when foreign availability of items makes U.S. controls ineffective. These determinations are crucial to minimizing the drag on competitiveness, and they require difficult fact gathering and complex technical analysis. OFA now has about two dozen people.

Another option would be to encourage political appointees with technical background. Technically knowledgeable senior BXA staff might be better able to argue their positions with other agencies.

Finally, there is an emerging problem of "North-South" or "foreign policy" controls, issued under Section 6 of the EAA (see box 4-C). (The term "North-South" is a convenient shorthand to distinguish the orientation of these controls from that of East-West controls. However, the use of this term is not meant to imply that all or most developing countries give cause for concern.) Some foreign policy controls aim to prevent proliferation of weapons of mass destruction, including missiles and chemical and biological weapons.[63] Other foreign policy controls, such as sanctions against countries that abuse human rights, are meant instead to make a political statement. Still other controls, such as sanctions against nations that use terrorism, appear to do both.

The Gulf War heightened concern over proliferation, and prompted the Administration's Enhanced Proliferation Control Initiative (EPCI). Although this concern is justified, the Administration's use of foreign policy controls takes little account of competitiveness concerns. The Administration must report and just@ foreign policy controls annually to Congress, but the safeguards against unnecessary interference with commercial exports (e.g., the prohibition on controlling items with foreign availability and the prohibition on unilateral controls) do not apply to foreign policy controls. Thus, changes already adopted for export controls related to East-West national security matters (under Section 5) do not extend to controls directed to foreign policy purposes (Section 6). This made it possible for the Administration to impose unilateral controls in March 1991 on certain chemicals and manufacturing equipment that could be used to make chemical weapons. In August 1991 the Administration issued regulations that could be interpreted to require virtually all firms exporting any items to any countries to set up a monitoring and control system to guard against diversion of any products to chemical or biological weapons plants (ch. 4).

If Congress believes that competitiveness concerns should, when possible, apply in the same way to foreign policy controls, a first step might be to separate foreign policy controls with military objectives from those with political objectives. To achieve political objectives, unilateral controls or controls on items available elsewhere could be appropriate and effective. Congress could include a strongly worded statement of policy that export controls for political reasons should be issued only after careful consideration of the effect on commercial exports.

Congress might put foreign policy controls with military objectives under more or less the same discipline as national security controls. This is not a simple matter. It would not make sense, for example, to simply state that proliferation controls will henceforth be treated under Section 5 rather than Section 6, because controls under Section 5 are meant to keep items from former Communist bloc nations, and the law is written so as to coordinate controls through CoCom. However, control of the technologies for nuclear weapons, missiles, chemical weapons, and biological weapons is broader than an East-West issue. The Soviet Union and the People's Republic of China possess much of the important technology, and must join in controls for them to be effective. Similarly, to deny conventional weapons to countries sponsoring terrorism would also require the cooperation of the Soviet Union and China. Therefore, Congress might wish to treat foreign policy controls with the objective of denying military technology in a separate section of the law, which imposes discipline regarding, e.g., foreign availability, but recognizes their special international position.

GOVERNMENT-INDUSTRY PARTNERSHIPS

One thing that stands out in the story of nations that successfully use trade policy to promote the development of particular industries is that trade policy alone is not enough. Even when used aggressively, it is combined with promotion of technology development and diffusion, with risk-sharing between government and industry, and with support for adoption of new technologies and industrial success.

Strategic Technology Policy

The least intrusive and least expensive of several possible risk-sharing options between government and industry is what OTA has described as strategic technology policy, an R&D partnership for developing new technologies of commercial interest.[64] The potential benefits to society of such ventures are great, but the likely payoff to individual firms is too small to make it worth their taking all the risk. Therefore, the argument for industry/government risk-sharing takes on special force.

Traditionally, U.S. policy has been to limit R&D support to basic science or else to the government's own needs—primarily, military security. There are notable exceptions: agriculture and civilian aircraft manufacture have had longtime steady support for technology development, based on a frank recognition that they were important to the nation's economic welfare. With the dawning awareness that U.S. industries really are in competitive trouble, a consensus seems to be growing for a Federal role in commercially promising R&D.

Congress took a first step in the 1988 Trade Act, which launched a small program for R&D partnerships, the Advanced Technology Program (ATP) located in the Commerce Department's National Institute for Standards and Technology (NIST). The Program's purpose is to help U.S. business rapidly

commercialize new scientific discoveries and apply research results toward refining manufacturing technology. Through the ATP, NIST can assist private R&D ventures with technical advice or can actually participate in them: it can provide start-up funding; put up a minority share of the cost; or lend equipment, facilities, and people. Congress has consistently taken the lead with ATP, providing its first funding of $10 million in fiscal year 1990 and raising the ante to $36 million in fiscal year 1991.

The Administration, for its part, has moved toward support of cooperative R&D for commercial ventures. The President's 1992 Budget proposal said: "The Administration believes that appropriate Federal investments in applied civilian R&D can result in high payoff to the economy . . ."[65] The Budget document went on to say that the principal strategy for Federal applied civilian R&D is to support agency mission requirements. But some of this R&D has broad applications in the private sector. In such cases, the government would support "generic or enabling technologies at the precompetitive stage of R&D.' These terms were defined as follows:

- generic or enabling technologies have the potential to be applied to a broad range of products or processes across many fins;
- precompetitive R&D is the stage of the R&D process where the results can be shared widely within and between industrial sectors, without reducing the incentive for individual firms to develop and market commercial products and processes based on the results.

The intention of such definitions is to avoid favoring particular firms or industries, putting government money into technologies with broad applications across firms and sectors. This principle ties in with the idea that technologies with many spillovers and applications are of most potential benefit to society. It is not always possible, however, to distinguish so neatly between technologies and industries. For example, flat panel displays are a generic technology, having myriad applications from home television sets to engineering work stations to airplane cockpits. But government support for developing the technology benefits the electronics industries and firms that produce it.

Congress has already indicated its interest in an industry-government partnership for applied commercial technology development that is not necessarily dependent on fallout from other government missions. If this program is to take a proactive, coherent approach, rather than responding to crisis calls from industries under competitive siege or to a wave of enthusiasm for the latest technology, it would need an agency in charge and a set of guiding principles. These issues are discussed briefly below.[66]

A Civilian Technology Agency (CTA) would be needed to guide government-industry cooperative R&D whether or not the idea of broader, integrated competitiveness policies in support of selected critical industries wins acceptance.

NIST's ATP might in time become a fill-fledged CTA, although it was not created with that explicit mission. Bills to establish more formally an Advanced Civilian Technology Agency in a new Department of Industry and Technology (which would replace the Department of Commerce) were introduced in the 100th and 101st Congresses.[67] These proposals defined the agency's mission as contributing to U.S. competitiveness by supporting long-term, high-risk projects likely to yield important benefits to the Nation but that lack adequate private support. A bill that passed the Senate in 1989 would have given the ATP a similar mission and authorized substantially increased funding, up to $100 million per year.

Any CTA would have to start small, as the ATP has, and need never grow very large. A possible model is the Defense Advanced Research Projects Agency (DARPA), a small free-wheeling Department of Defense (DoD) agency supporting risky long-term R&D that often has commercial as well as military value. DARPA has 150 employees, about half of them scientific and technical, and some $1.5 billion a year for its research projects. Its relatively small size is one factor in a nonbureaucratic culture that gives staff members a great deal of freedom to exercise their own good judgment. At the same time, a research budget of $1 to $2 billion a year seems large enough to attract a critical mass of competent staff and fund a healthy portfolio of technologies.

Where in the Federal bureaucracy a CTA is placed may not matter too much. The prestigious National Science Foundation is an independent agency. DARPA is smaller than NSF and is a tiny part of the huge, hierarchical Department of Defense, but it too has won renown for its competence and dedication. If the small, experimental ATP develops into a mature CTA, the question may answer itself, since

the Program is already started life in the Department of Commerce.

Like DARPA, a CTA might attract excellent staff by combining freedom from bureaucratic rules with great responsibility and the opportunity to serve one's country. Unlike DARPA, a CTA would not serve a defined mission and customer—the military. Instead, technologies supported by a CTA would have to prove their worth in the market. Even allowing for inevitable failures-and an agency charged with supporting high-risk technologies would not be worth its salt if it had no failures along with its successes—it is much tougher to choose technologies that can make it commercially than ones with some credible military use.

Collaboration with industry is essential in choosing technologies for support. If private companies are not interested enough to take some of the risk and do some of the work, then the chances of commercial success are probably remote. Joint funding helps the government escape pressure from special interests in selecting technologies for support, and enlists market forces in picking the best prospects.

At the same time, a CTA would need a set of guiding principles to delineate broad areas appropriate for government-industry collaboration. One obvious principle is preference for technologies with wide applications in many products and industries. Another is knowledge-intensiveness, which means not only technologies important to industries that are clearly knowledge-intensive in themselves (e.g., computers) but also projects that could deepen the knowledge-intensiveness of traditional industries (e.g., precision machining). Another principle is potentially large markets.

The importance of collaboration with industry in selecting commercially interesting projects is underscored by NASA's (National Aeronautics and Space Administration) experiences over the years. NASA's annual spending for aeronautical R&D amounts to about $800 million, and probably 90 percent of that is, or could be, relevant to the commercial aircraft industry, as well as to the military. This is a huge amount for the United States. Of course the military connection is a leading reason for this level of spending; even so, the research is available to commercial producers. Yet it would be mistake to think that most of NASA's R&D, or even the major share, gives U.S. aircraft manufacturers a competitive advantage. Some of it is basic research, not applicable to commercial production except possibly in the very long term. Much of the advanced technology development is quite freely available to the world, and some has been used first by Airbus in Europe, not by U.S. producers (see ch. 8).

NASA's greatest contributions to competitiveness of American producers are in two areas: its facilities (e.g., wind tunnels and the Numerical Aerodynamic Simulator, a supercomputer complex), which are either preferentially or solely available to U.S. companies; and technology development projects in which the U.S. companies were close collaborators (as in the E^3 program for aircraft jet engines, described in vol. 2, to improve fuel efficiency and reduce emissions and noise). Coordination between new government regulations and collaborative technology development projects to help comply with the regulations can give an extra boost to competitiveness; this was the case with Federal regulations to reduce aircraft noise.

There are at least two pluses to industry involvement in NASA's technology development projects. First, the projects are more likely to reflect genuine commercial concerns and possibilities; and second, the company engineers gain an intimate knowledge of the new technologies that outsiders cannot acquire simply by reading published research reports.

These advantages are just as valid outside NASA and the commercial aircraft industry. The few government-industry technology partnerships that already exist for manufacturing industries (apart from aircraft) follow the pattern of at least 50-percent funding by industry. Sematech, the largest of these ventures, gets $100 million per year both from the U.S. Government and from a consortium of industry members. The ATP follows a similar rule, with more than half the cost of cooperative projects paid by sponsoring firms. Although Sematech has its own facilities, the ATP-funded R&D takes place in members' labs. There are opportunities to do more cooperative work in Federal" labs, especially in the Department of Energy's well-equipped multiprogram national labs. However, judging by NASA's experience, these ventures will be of more use to companies if they involve participation by the firms' own researchers, not just a financial contribution.

So far, the U.S. Government's offers of collaborative R&D projects have been snapped up by private

companies. Sematech was, in fact, proposed by the semiconductor industry, which lobbied hard for it. Three small pilot projects ($5 to $6 million per year total) in the national labs for commercializing high-temperature superconductivity had more willing partners from industry than the labs could fund, and the same was true of DARPA's $30 million project for cooperative R&D on high resolution display technologies. ATP's first batch of grants for cooperative projects amounted to about $9 million, initiating R&D programs that are expected to cost $100 million (including private funds) over 5 years. The 11 winning grants were selected from 249 proposals requesting a total of $150 million (box 2-B provides details).

Added together, the dollar amounts in these few cooperative programs are minute in a Federal budget of more than $1 trillion. They are tiny compared to the more than $90 billion per year that U.S. manufacturers spend for R&D. It is noteworthy, however, that such very modest programs have drawn responses from so many companies, large and small. Among ATP's first 11 grantees were industry giants such as Du Pent, AT&T Bell Laboratories, and two prominent industry consortia, the Microelectronics and Computer Technology Corp. and the National Center for Manufacturing Sciences. Although these companies and consortia have big R&D budgets of their own, each one funds a great many projects, and there are always promising but risky ones that do not make the corporate cut. However, such projects may look more attractive with cooperative funding, including government money. Furthermore, the government backing may lend a certain prestige to the undertaking. Or companies may fear missing out if their competition joins in and they do not.

So far, Congress has taken a gradual approach to expanding government partnerships with industry on commercially relevant R&D. This approach makes sense, considering that the U.S. Government has little experience with industrial partnerships; that the government's institutional ability to manage R&D partnerships is at an early stage; and that relations between government and industry in this country have traditionally been adversarial. If Congress wishes to continue this measured expansion, with the ultimate goal of having an agency about equal in size and importance to DARPA or the National Science Foundation, it may opt for a modestly increasing ATP budget for several years. It might also wish to consider writing into law a more formal statement of goals for the agency.

Participation by foreign firms in cooperative R&D programs that receive government funding is a new and somewhat unsettled question. Part of the problem is in defining just what a foreign firm is (see ch. 3). In appropriating funds for the ATP for fiscal year 1991, Congress took on the problem in an innovative way. It set standards that apply to U.S.-owned as well as foreign-owned firms, thus bypassing ownership as *the* central criterion for deciding whether a firm can participate in ATP projecta.[68] The Secretary of Commerce is authorized to decide whether firms are eligible, using the standards to determine that their participation would be "in the economic interest of the United States."

The standards applying to all firms call for investments within the United States in research, development, and manufacturing, including the manufacture of major components or subassemblies (thus insisting that investments go beyond assembly plants that add little value or knowledge-intensiveness); a significant contribution to employment in the United States; and agreement to promote U.S. manufacture of products resulting from ATP-assisted technology projects. Further conditions apply to foreign-owned fins: they may participate if the Secretary finds that their home country offers U.S.-owned firms comparable opportunities to take part in joint ventures for technology development, allows U.S. companies to invest on equal terms with other countries, and affords adequate protection of the intellectual property rights of U.S. companies.[69]

These provisions offer guidance but also give great latitude to the Secretary of Commerce in determining the eligibility of firms, both foreign and domestic, for ATP projects. Congress may wish to exercise substantial oversight for a time on how these novel provisions are carried out.

Financial Risk-Sharing

A strategic technology policy, worthwhile as it may be, goes only so far. Government partnership in technology development stops short of commercialization. After that, it is up to industry to make the much larger investments in the product design, manufacturing equipment and tooling, worker training, and acquisition of know-how by managers and production engineers that are necessary for the commercial manufacture of new or improved prod-

Box 2-B—The Advanced Technology Program's First Round

The U.S. Department of Commerce announced in March 1991 the first awards under the innovative Advanced Technology Program (ATP). The ATP was created by Congress in 1988 to help American business turn research results into new commercial products and improved manufacturing technologies. It established a government-industry partnership, in which the ATP could lend technical assistance, equipment, and people to cooperative research projects and could contribute a minority share of the funding.

Awards of about $9 million went to 11 grantees and were first installments in R&D programs expected to cost $100 million over 5 years (with more than half the money coming from private industry).[1] The 11 winners were chosen from 249 proposals requesting $150 million in first year grants, Several hundred volunteer reviewers from both government and industry helped to make the choices. Of the 11 grants went 5 to joint ventures or consortia-an indication, according to Commerce Department officials, that the program is fostering a greater spirit of cooperation among highly individualistic companies for precompetitive R&D.[2] The program encourages joint efforts and rewards them with grant money that covers some indirect as well as direct costs.

Most of the technologies were related to microelectronics and computers, including optical recording and computer hardware. Others were in the fields of high-temperature superconductivity, machine tool control, and novel laser designs. The grantees, their projects, and the grants they requested, are described below.[3]

Printed Wiring Board Interconnect Systems

National Center for Manufacturing Sciences, Inc. (NCMS)

Printed wiring boards are ubiquitous in electronic products, from radios to computers. The U.S. share of a $25 billion world market has dropped from 42 to 29 percent in 3 years. Current technology is approaching fundamental limits in the materials and processes now used. Four members of the NCMS consortium, AT&T, Texas Instruments, Digital Equipment Corp. and Hamilton Standard Interconnect will work with Sandia National Laboratories to develop new materials, better processes, and improved technical understanding.

First year request: $2,370,000; total 5-year request: $13,783,000; matching funds: $14,674,000

Volume Holographic Mass Storage Subsystem

Microelectronics & Computer Technology Corp. (MCC)

MCC proposes to build on a basic concept it has already demonstrated for a radically new form of dense, ultra-fast computer memory storage, potentially replacing slow disk drives and magnetic tape (about 100,000 times slower than the typical microprocessor). The new system would respond in microseconds, and would store data as holographic images in photorefractive crystals.

First year request: $823,000; total 5-year request: $10,331,000; matching funds: $12,700,000

Advanced Manufacturing Technology for Low Cost Flat Panel Displays

Advanced Display Manufacturers of America Research Consortium

Advances are needed in testing and repair equipment, as well as in interconnection and packaging technologies, to successfully commercialize high-quality, low-cost flat panel displays. Three relatively small companies will lead a consortium in a linked series of research programs; they are Optical Imaging Systems (Troy, NY), Photonics Imaging (Norwood, OH), and Planar Systems, Inc. (Beaverton, OR). Seven other companies are participating.

First year request: $1,251,000; total 5-year request; $7,305,000; matching funds: $7,604,000

Short Wavelength Sources for Optical Recording

National Storage Industry Consortium

Data storage devices are a $50 billion-per-year industry; two-thirds of the market is now controlled by U.S. firms, one-third by Japanese. The most promising technology in the field is optical recording, as used in compact disks. The program would develop an integrated short wave length laser source, with solid state components, for read/write heads of fast, small, rugged optical memory devices. Members of the consortium, which is not yet fully

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[1] In some cases, part of the company contribution is in kind (e.g., laboratory equipment), so that the government grant requested may be larger that the cash outlay proposed by the company.

[2] "Advanced Technology Program Clears Another Hurdle," New *Technology Week,* Mar. 11, 1991.

[3] The descriptions are taken from U.S. Department of Commerce, Office of the Secretary, *Commerce News,* press release dated Mar. 5, 1991 and "First Winners in the Advanced Technology Program," New *Technology Week, Mar.* 11, 1991.

formed, include Applied Magnetics, Bernoulli Optical Systems, Eastman Kodak IBM, Maxoptix Corp., and the University of Arizona. An initial grant of $50,000 is contingent on further development of the joint venture.

First year request: $50,000; total 5-plus years request: $5,421,000; matching funds: $9,200,000

Fabrication and Testing of Precision Optics for Soft X-Ray Projection Lithography

AT&T Bell Laboratories

X-ray lithography is a key technology for new generations of dense microelectronic circuits. This program will attack a key problem limiting projection X-ray lithography: the manufacture, testing, and assembly of relatively large scale X-ray mirrors. It will develop technology to test, fabricate, assemble and align aspherical X-ray mirrors. Three-quarters of the grant will go to small business subcontractors.

First year request: $955,000; total 5-plus years request: $2,000,000; matching funds: $3,525,000

Solid State Laser Technology for Point Source X-Ray Lithography

Hampshire Instruments, Inc. and McDonnell Douglas Electronic Systems Co.

These small companies will lead a joint venture to exploit recent advances in laser materials for use in low cost, high-performance X-ray lithography.

First year (total) request: $1,090,000; matching funds: $1,094,000

Nonvolatile Magnetoresistive Semiconductor Technology

Nonvolatile Electronics, Inc.

Computer memory is volatile--the data vanish when the power is shut off. This program aims to develop a fast, dense, nonvolatile memory, basing the technology on a magnetoresistive memory (MRAM) patented by Honeywell and intended for space and avionics applications. The company has licensed the technology for nonaerospace applications, and means to develop it as a competitor to conventional dynamic random access memory (DRAM) semiconductors.

First year request: $599,000; total 3-year request: $1,738,000; matching funds: $869,000

New User-Interface for Computers Based on On-Line Recognition of Natural Handwriting

Communication Intelligence Corp. (CIC)

CIC plans a robust natural handwriting recognition system that does not require "training" the computer to recognize each individual's handwriting (a key limitation of most current systems). Cursive handwriting input for computers could be a revolutionary advance, especially for notebook and laptop machines.

First year request: $671,000; total 2-year request: $1,264,000; matching funds: $912,000

Advanced Thallium Superconductor Technology

E.I. du Pent de Nemours & Co.

The proposal is to develop thin-film fabrication techniques for a new, proprietary high-temperature superconductor invented by Du Pent. Project includes developing fabrication techniques and creating representative superconducting electronic devices to demonstrate feasibility.

First year request: $370,000; total 3-year request: $1,590,000; matching funds: $784,000

Tunable Deep UV and VUV Solid State Laser Source

Light Age, Inc.

The company will apply recent developments in laser technology to produce high-average power ultraviolet lasers that are cheaper, safer, more reliable and easier to use than current products. Potential applications are in medical and scientific instruments and materials processing. It could be particularly significant in photolithography for the semiconductor industry, challenging the dominant Japanese suppliers of semiconductor production equipment.

First year request: $627,000; total 1.5-year request: $701,000; matching funds: $254,000

Advanced Compensation Techniques for Enhancing Machine Tool Accuracy

Saginaw Machine Systems, Inc.

The program seeks a general, economic solution to the problem of correcting for errors in machining caused by thermal expansion and contraction of the machine tool; thermal errors contribute to about half of the errors in machining. Working with the University of Michigan, Saginaw will develop a mathematical model of thermal errors and a sensor and computer control system that can help machine tool builders greatly improve the accuracy of their machines at reasonable cost.

First year request: $266,000; total 2-year request: $540,000; matching funds: $168,000

ucts or the adoption of new manufacturing process technology. It is normal and expected for private industry to make these investments, take the risks and then, if all goes well, reap the rewards.

Sometimes, however, in some critical sectors, private investment is inadequate from the standpoint of social benefits. Take semiconductors. One important reason why U.S. companies have lost out to Japanese firms over the last decade is that Japanese rates of investment were higher. From 1982 until 1991, Japanese producers invested a larger share of their sales of integrated circuits in plants and equipment than did U.S. producers, and since 1984 have out invested their U.S. rivals in absolute amounts .70 This pattern holds true in all industries throughout both economies; Japanese investment in machinery and equipment as a share of gross domestic product has consistently run at double the U.S. rate since the mid- 1970s, and in the late 1980s the discrepancy widened. This bodes ill for U.S. competitiveness generally, but in the technology-dependent semiconductor industry, where new generations of products are introduced every 3 years or so, the disadvantage can be crippling.

The relatively meager U.S. investments in new production equipment reflect high capital costs and a financial environment that discourages or fails to support long-term investment (see the summary discussion in ch. 1 and more detailed discussion in OTA's 1990 report, *Making Things Better).* Macroeconomic policies that lower interest rates and provide stability are probably the most important things government can do to encourage greater investment in technology development and deployment by U.S. manufacturing companies. There are other options as well, however.

Besides the generally unsupportive financial environment in the United States, American semiconductor companies have the added handicap of facing Japanese competitors that are much larger; are vertically integrated, from semiconductor chips through computers; make a much greater variety of end products (VCRs and compact disk players as well as computers); and have ample retained earnings for new investments. Yet formidable as they are today, Japanese companies were not always preeminent. In the 1970s, they had a catch-up job to do that was greater than the one facing U.S. companies today. They did it not only by hard work and effective management but also with government policies that gave them protected domestic markets, tight controls over foreign investment, guaranteed sales to important government customers, government-industry R&D partnerships, and a variety of measures assuring plenty of low-cost capital at a time when companies' financial resources were much more limited (see ch. 6).

Government policies to share financial risks with industry can take the form of subsidies or loans on advantageous terms, or they can take the more indirect form of tax breaks (i.e., tax expenditures). Both put burdens on government resources and, under the Federal budget agreement adopted in 1990, Congress cannot opt for either without compensating tax rises or spending cuts in other domestic programs.

Of the two forms of financial risk-sharing, tax expenditures are more within U.S. traditions and experience. U.S. companies in the past have received accelerated depreciation and tax credits for capital investments, and they currently get a tax credit for R&D (although Congress has not made this a permanent feature of the tax system but instead has renewed it from year to year). Although certain kinds of investment (e.g., real estate) have been singled out for specially favored tax treatment, Congress has not in the past designed these tax incentives to improve the competitiveness of particular industries.[71] If Congress wishes to target tax breaks to selected industries because of their importance to the U.S. economy, the best way to do it is make the tax measures part of a comprehensive strategy that also includes such things as R&D partnerships and trade policy.

Many governments have supported selected industries with more direct financial aid, in addition to tax incentives. Japan, for example, offers companies *hojokin* (success dependent loans) for risky enterprises in selected industries; payments can wait for a positive cash flow. Thus companies are insulated against catastrophic losses. European governments have done much the same for Airbus. The U.S. Government, by contrast, has had little experience in giving direct financial aid to selected industries for strategic competitive purposes. There have been some well-publicized government bailouts of failing individual companies, notably Lockheed and Chrysler. The Synfuels program of the late 1970s did have the purpose of energy independence; that program is generally considered a failure. The broadest U.S.

experience with direct loans to industry (leaving aside special loan programs for small business) was the Reconstruction Finance Corp. (RFC) in the post World War II years.[72] RFC was created in 1932 to shore up banks in the credit deflation of the Great Depression, and it went on to procurement of strategic materials for national defense during the war. The postwar RFC had no such clearly defined purpose. In practice, it spent most of its very ample resources (close to $1 billion per year in 1946-47, translated into 1990 dollars) in bailing out large, prominent but floundering companies, such as the Kaiser-Fraser automobile company. The one RFC project that seemed to have any focus other than keeping a big firm afloat was a series of nine loans to the Lustron Corp., which boasted a new technology—manufactured steel-frame houses. The project failed, and accounted for RFC's biggest loss.

RFC's failure in the postwar years was surely due in large part to its lack of any strategic purpose or guidance. However, its failure also suggests some dangers inherent in government's giving large sums of money to companies that cannot get funding from private sources. This cautionary lesson has been learned so well that now even suggestions for direct financial aid from government to industry are few and far between. In its 1989 report to the President and Congress, the National Committee on Semiconductors (NACS) did propose an attenuated form of government loan guarantees to U.S. companies trying tore-enter the advanced consumer electronic business.[73] The idea was that the semiconductor industry is handicapped by the lack of a U.S. consumer electronics sector, considering the remarkable convergence of technologies in consumer electronics and other electronics goods (e.g., computers). NACS proposed a private corporation, to be backed by "pledges of support' from Federal, State and local governments, that would provide low-cost patient capital to startup consumer electronics companies with U.S. ownership. The suggestion was not repeated in the second NACS report in 1991. Some committee members privately offered the explanation that members could not agree on technical details for the proposed corporation, and said that the committee may take up the issue again in its third and final report.

The likelihood of a revived consumer electronics sector in the United States under U.S. ownership is virtually nil without infant industry assistance from the government; this might include trade protection and technology partnership as well as financial aid. However, whether such a revival is necessary or important to the U.S. economy is no simple question. It includes the issue of whether foreign-owned companies producing in the United States (Sony, Philips North America, Thomson) might provide the same benefits. Moreover, reviving a consumer electronics industry is a big, expensive job, and could be quite a burden to the taxpayers even if government took only a minor share of the risk. If Congress does wish to consider direct financial aid to this or other selected industries, it may want to start with a program of very modest scale and increase it slowly. Having a large pot of money available for such ventures invites imprudence, even for an experienced institution. And the United States does not now have an institution with the experience or capacity to fit financial aid into a coordinated strategic competitiveness policy.

Government Purchases

Government procurement was a vital factor in the birth and early growth of several important U.S. industries: semiconductors, computers, aircraft, and aircraft engines. As might be inspected, the big buyer in each case was the Department of Defense (DoD). For semiconductors, for example, the amounts DoD spent in the early years were tiny compared to the sums spent today, yet the DoD then was the launch customer for a product and technology in its infancy, and bought nearly 100 percent of the industry's output. Today, the Federal Government might still be a valuable first customer for untested products that combine public benefits with the potential for competitive success. It might also be an important customer for existing products important to U.S. competitiveness.

However, the opportunities are somewhat limited. Ninety percent of Federal purchases of goods are for defense and DoD does buy large amounts of certain important products. The share of aircraft and aircraft engine production for defense is about 43 percent; for radio and TV communications equipment, 36 percent; and for electronic components, 23 percent. But much of this equipment is so highly specialized for military use that technological spillovers to the commercial side are limited; in fact, because of long lead times for developing weapons, some commercial technologies are far ahead of military applications. Technological spillovers from the military appear to be diminishing, although the evidence is

mixed. What is certain is that restrictive laws and DoD regulations have made it increasingly difficult for companies to take advantage of whatever technological synergies may exist.

Nondefense purchases comprise less than 10 percent of the total Federal purchases of goods, only $10.3 billion in 1990 out of $107 billion total. The United States has no national telecommunications service, no national railway, no national airline, no national health service, and no national university system. In both Japan and Europe, government bodies of these kinds have been important buyers of such products as semiconductors, computers, telecommunications equipment, aircraft, rolling stock, and medical equipment, and have used their purchases to support domestic industries.

The Federal Government's track record in improving manufacturing competitiveness, whether as a launch customer for new products or an important customer for established products, is weak. This is partly because competitiveness is not a goal of U.S. procurement policy. Preferences for U.S. goods are not motivated by strategic economic considerations; any benefit to commercial manufacturing competitiveness is usually just a happy coincidence. In contrast, the United States' most important trading partners do use procurement to promote certain manufacturing industries.

Key U.S. trading partners have much less open procurement than does the U.S. Government. The United States has been trying to make foreign procurement markets more accessible. First, the United States is negotiating to expand the scope of the GATT Procurement Code. Under the Code, the United States and the other signatories, which include the United States' major trading partners, grant reciprocal access to each others' procurement markets for covered purchases. However, the Code currently covers only a modest amount of those purchases.[74] Second, the United States has begun renegotiating several of the 19 Memoranda of Understanding (MOUs) with allies regarding defense procurement. These MOUs have substantially opened the U.S. defense procurement market but have not had the same effect on allies' defense procurement markets. Third, the United States has negotiated under Title VII of the Omnibus Trade and Competitiveness Act of 1988.[75] Under Title VII, the U.S. Trade Representative is to identify cases of procurement discrimination, including important cases not yet covered by the GATT Procurement Code, and to negotiate improved market access. If negotiations are unsuccessful, the United States can retaliate by discriminating in its own procurement against goods from the country in question (see ch. 4).

The U.S. Government might try other tactics to improve access to foreign procurement markets. If some Code signatories appear more willing than other to open their procurement markets, the United States might then consider creating a kind of Gold Club Membership GATT Code with countries that agree to abide by very strict rules and enforcement procedures. Members would have broad reciprocal access to cosignatories' public contracts. There could even be a Gold Club Federal Contracts Journal in which participants advertise their procurements no later than they are announced elsewhere.

However, based on experience with other types of market barriers, a strategy based primarily on opening foreign procurement is likely to bring disappointing results. If closed foreign procurement is hurting important U.S. industries, the United States could also use domestic measures, such as R&D support and tax breaks, to promote the industries in question.

In addition, the United States could use its own procurement strategically to develop important technologies and industries. Some measures could be taken consistent with U.S. obligations under the Current GATT Procurement Code and MOUs. For example, current U.S. law restricts defense purchases of supercomputers to U.S. machines. This has been an important help to the U.S. supercomputer industry, and a change in that policy would increase the already substantial risk that the United States will lose dominance to Japan (see ch. 6).

As another example, the GATT Procurement Code does not now cover the U.S. Postal Service. The Postal Service would be an ideal launch customer to develop an electric vehicle industry, since the limitations of electric vehicles under current technology-short range and need for frequent recharging-would not be a problem for the vehicles used to deliver local mail. Procurement of U.S.-made electric vehicles by the Postal Service could provide the United States a sharp advantage in a new industry for which the United States, Europe, and Japan are all competing to develop the technology. If the United States considered an electric

vehicle industry worth promoting, it might want to keep the Postal Service outside the Procurement Code until the industry was well on its way. Of course, the United States might still decide to subject the Postal Service to Procurement Code discipline in exchange for concessions by other countries. The important thing is that such opportunities not be bargained away thoughtlessly.

It is not clear how many such opportunities exist. Much Federal procurement is subject to neither the GATT Procurement Code or the defense MOUs. Even the best estimates are rough. In 1990, Federal procurement of goods and services amounted to $229.6 billion, of which $181.5 billion was for defense.[76] Of the $48.1 billion in nondefense spending, perhaps roughly $4.6 billion was covered by the Procurement Code,[77] leaving $43.5 billion uncovered. Of the defense procurement, probably at most $109.2 billion was covered by MOUs and/or the Procurement Code,[78] leaving at least $72.3 billion uncovered. While some of these uncovered amounts are for services (beyond the scope of this report), probably at least $5.7 billion in uncovered nondefense procurement is for goods,[79] as might be a substantial portion (perhaps $30 billion or more) of the uncovered defense procurement.[80] Probably only a small part of the uncovered procurement could be of strategic importance. However, Congress might wish to mandate that these strategic opportunities be assessed.

Even when purchases are covered by the GATT Procurement Code or other international agreement, the U.S. Government could help industry without breaking international rules. This code does not cover R&D contracts, so the government could award such contracts to U.S. firms to enhance their position to bid on covered purchases. For example, if the Postal Service were to be covered by the Procurement Code, it could still award R&D contracts relating to electric cars to U.S. firms before soliciting bids for a fleet.

There might also be a competitiveness bonus in standards development. The GATT Procurement Code permits countries to require national standards in government contracts; companies at the forefront in developing both standards and corresponding products would have a head start in winning the contracts. R&D funding can be applied to develop national standards that are then included in product specifications, as with the Research and Development in Advanced Communications in Europe Program (RACE) of the European Community (see ch. 5).

In addition, all government contract specifications might be shaped to conform as closely as possible to commercial products made by U.S. industry, or to planned commercial products. For example, the specifications on a purchase of electric cars by the Postal Service might be written to make production of those vehicles a stepping stone toward U.S. fins' planned commercial production.[81] Such a purchase might also be timed to fit the product cycle of U.S. fins.

With direction from Congress and the President, each agency could seek out opportunities such as these where Federal procurement and associated R&D spending can help competitiveness. However, if one agency had overall responsibility for competitiveness, it might work with other agencies to find and coordinate such opportunities. That agency could do the same with State and local governments, advising them on how working their procurements could help U.S. competitiveness. While some State and local governments have some preferences for U.S. goods, they are not coordinated into any national policy or strategy. The agency could act as a clearinghouse to help State and local governments find U.S. suppliers.

State and local procurement could be a powerful tool for competitiveness. One reason is size. In 1990, State and local government spending on goods was $87 billion, compared with the Federal Government's spending of $107 billion (all but $10 billion for defense). For certain items, State and local purchases are a significant part of the market. For example, in 1990 States and localities spent an estimated $8 billion on cars and trucks,[82] amounting to 6 percent of U.S. motor vehicle sales that year. Also, State and local governments are not now governed by the GATT Procurement Code.[83] Thus, State and local governments have more freedom than the Federal Government to grant preferences for U.S. firms.

INSTITUTIONS FOR A STRATEGIC COMPETITIVENESS POLICY

In each of the policy areas discussed above, the Federal Government could take many constructive actions. Government efforts to encourage invest-

ment and savings, enhance human resources, encourage commercial technology development and adoption, and take a more proactive stance in trade policy could help many industries become more competitive. Yet a host of individual actions, undertaken piecemeal, do not add up to a coherent strategy. At present, the Federal Government does not have an institutional structure capable of a strategic, integrated approach to competitiveness and trade policy.

As part of a more proactive approach, the Federal Government might choose to focus various government policies on assistance to critical commercial industries. One element in this strategy is development of criteria that would keep the list of eligible industries short and highly focused. Those on the short list might qualify for priority technology or financial assistance offered by Federal agencies or possibly for special consideration in U.S. trade policy.

If Congress wishes to proceed with this kind of initiative, stronger institutional capacity in the Federal Government would be needed to provide the careful analysis of trade and competitiveness issues that would lead to rational choice of strategies and industries. At the very least, the Government would need the analytic capability to identify candidate industries, to develop action-oriented strategies tailored to specific industries, and to delineate specific government actions, programs and policies. The strategy would need to be industry led, with eligible industries extensively involved in shaping feasible approaches and selecting candidate industries, and in making substantial investments in whatever government-industry partnerships are undertaken. Government decisionmakers would need to make sure that the choices are consistent with the overall goals of the program and criteria for selection.

A coordinated strategy to support critical industries might not get much attention if it were assigned to an existing line agency already saddled with numerous trade and industry responsibilities. Thus, Congress might establish a new organization in the executive branch to develop strategic competitiveness policies. The office could be small, since its role would be largely analytical and catalytic. But it would have to be well and prominently positioned (e.g., in the Executive Office of the President) to effectively leverage or influence actions of key trade and commerce agencies, and it would need Administration support to have clout.

A strategic competitiveness policy will accomplish little unless it prompts action on the part of the many Federal agencies with responsibilities in such diverse areas as foreign trade, research and development, antitrust, and taxation. Recognition is growing among Federal agencies that there are many links between policies affecting domestic industry and foreign trade. However, the two are seldom carried out in concert.

Thus, a strategic competitiveness policy would require a coordinated response by Federal agencies. A certain amount of restructuring and reorganizing of current Federal functions could help. For many years, Congress has been debating whether to rearrange the wide array of Federal trade and commercial programs into new departments or agencies. A purpose underlying most of the proposed reorganizations is to create a more coherent organizational structure for U.S. Government decisions on international trade. If Congress does establish such a department, strategic competitiveness policy could be one of its responsibilities.

At the end of this section, two organizational options are discussed in greater detail, in light of the criteria and objectives discussed immediately below. The two options are not exclusive of each other. The more modest option, establishing a "critical commercial industries office' in the executive branch to formulate and coordinate implementation of strategy in support of critical industries, could well be part of a more far reaching departmental and trade agency reorganization that has as one its goals furthering strategic competitiveness policy. Congress might also use advisory committees as a first step in identifying industries and recommending actions for subsequent adoption by the executive branch or Congress. For example, the newly launched Competitiveness Policy Council might undertake this function,[84] while the National Advisory Committee on Semiconductors (see box 2-C) could serve as a model for developing strategies for specific industry sectors. Although advisory committees can be useful in identifying problems and needs, only agencies and departments have the authority to implement policies or coordinate Federal responses. Hence, legislation or additional executive action would still be required.

Box 2-C-National Advisory Committee on Semiconductors

The National Advisory Committee on Semiconductors (NACS) is an example of a joint effort by industry and government to address the problems of a specific industry sector--in this case the troubled American semiconductor industry. Congress established the committee in the 1988 Omnibus Trade and Competitiveness Act, calling on NACS to "devise and promulgate a national semiconductor strategy." Its final report, scheduled for late 1991, is expected to lay out an overall strategy, including possible trade policy approaches. In the meantime, NACS has issued two interim reports outlining the problems of the American semiconductor industry and making specific recommendations for action by Congress and the administration.

The committee is structured to assure extensive interaction between industry and government in developing the strategy. NACS is technically an independent advisory body in the executive branch. Eight prominent industry executives serve on the committee (the president of AT&T Bell Labs serves as chairman), as do five high-ranking government officials with key responsibilities for research and development or technology policy.[1] (The agencies include Defense, Commerce, the Energy Department, the National Science Foundation and the Office of Science and Technology Policy (OSTP).) A Defense Advanced Research Projects Agency official saves as Executive Director, under agreement with OSTP. The committee, which meets every other month, also has setup several working groups to address specific issues. The working groups typically include some committee members and outside experts.

NACS's first two reports, issued in late 1989 and early 1991, recommended several government actions as initial steps toward achieving a national strategy. Some of the recommendations were quite general, such as improving the education and training system, and creating a favorable business environment for all industries. Others were specific to the semiconductor industry, emphasizing, for example, research and development actions Federal agencies could take to further semiconductor technology.

It is probably premature to talk about NACS's overall impact on executive branch policy, Congress, or the industry itself, since it has yet to issue its strategy. Because Federal officials serve on NACS, its suggestions may have influenced some agency R&D actions. It also has helped elevate visibility of semiconductor issues in the Administration. (Committee members met with President Bush's chief of staff, John Sununu, as well as Office of Management and Budget Director Richard Darman and Michael Boskin, who chairs the President's Council of Economic Advisors.) NACS's interim reports have also helped define the terms of the debate about semiconductor problem areas.

[1] Nonfederal committee members are appointed by the President, through the Office of Science and Technology Policy. The law states that four of the nonfederal members were to be selected from the semiconductor industry; the other four were to be eminent in technology, defense and economic development.

A proactive strategy does not mean that government would produce a blue print or plan for industry. Instead, the critical industries organization could champion competitiveness, and other domestic policies. It could encourage agencies to give priority for some forms of government assistance (e.g., technology help) to critical industries. It could also encourage agencies to take competitiveness concerns into account when making regulatory decisions that affect a critical industry.

Selecting Industries

There are many reasons why governments adopt protective stances toward specific industries, ranging from national defense, to economic security, to a desire to mitigate the impact of import competition on communities, firms, and workers. Often, the reason for protection is simply that an industry has the political leverage to gain it.

Implicit in the concept of strategic competitiveness policy is the idea that certain critical industries are important for national economic security. Doubtless, the most promising candidates would come from manufacturing industries in the technological forefront for developing new products and processes. Such industries have a high proportion of technology-oriented workers and spend proportionately more on R&D. Examples include computers and software, electronic components, communication equipment, advanced materials, precision machining equipment, robotics, biotechnology, and aerospace.

Some critical industries would coalesce around new technologies that could in time provide dispro-

portionate returns to the firms or countries with the largest market share. There is not much disagreement about what technologies are critical to national economic prosperity and national security. Lists developed by several U.S. Government and business organizations in 1990-91 are remarkably similar (table 2-1).[85] And the conclusion is widely shared that U.S. industry's position in these technologies has weakened significantly in the past 10 years, and continues to weaken.

The benefits from commercializing these technologies could be large, as suggested by Department of Commerce's 1990 estimate that 13 emerging technologies might yield $356 billion in annual product sales in the U.S. market alone by the year 2000. Yet if current trends continue, the United States would lag Japan in most of these technologies and the European Communities in several.[86]

The element of criticality suggests not only technology intensity but also the potential to provide good new jobs and make large contributions to the economy. Thus, a critical industry might be an emerging or developing high-technology industry with large potential markets. Or a critical industry might produce technology or services that enable other industries to make dramatic advances in productivity and quality. The classic examples are machine tools and semiconductors. A rationale for a Federal role in developing a U.S. high-definition television (HDTV) industry is that it could drive technologies critical for other parts of the electronics industry. Consumer demand for HDTV could be sizable. This is one of several emerging industries in which Japan is ahead.

It is important to recognize that not every industry with a claim to leading edge technologies, growing markets, good jobs, and technology spillovers could be selected for support. Public and private resources, energy, and talents are limited. The judgment of industry leaders and their willingness to put up their own money in cooperative ventures are an invaluable guide to the selection of promising industries. This implies the necessity to develop new relationships of trust and shared visions of truly national interest between government and industry.

What Kind of Support?

The range of policy tools that might be used to support a strategic competitiveness policy includes those discussed in previous sections, such as technology partnerships, financial incentives, and trade policy. Some of the relevant programs already exist, or at least are on the books. To round out the array of policy tools, Congress could authorize some new ones. Options for expanding the list of these programs are touched on only briefly here, as they were discussed in more detail earlier in the chapter.

As noted above, financing long-term investment has been a particular problem for American industry, reflecting the high costs of capital and pressures to realize short-term profits. Federal policy affecting investment might be tailored to meet specific needs of a designated critical industry. For example, across-the-board loosening of depreciation rules for all American industry would be very expensive, but there might be merit to loosening the rules for specific critical industries. The public costs might still be considerable but the stimulus would at least be focused on the specific needs of industries found critical to the national interest. The National Advisory Committee on Semiconductors, for example, estimates that changing current depreciation rules for new investments in semiconductor manufacturing equipment from 5 to 3 years would cost the U.S. Treasury $180 million in lost tax receipts, but could prompt $450 million in capital investment each year by this industry .87

Almost by definition, technological advance will be a key factor in the competitiveness of critical industries. The creation of a CTA along the lines discussed earlier, or a major expansion of NIST's ATP, could help. While a coherent policy in support of commercially important technologies does not yet exist in this country, the Federal Government does take part in technology development that is useful to some commercial industries, notably NASA's aeronautics R&D program and the Sematech project. Generally, however, such support has not been part of a systematic effort to further U.S. competitiveness. Sematech, for example, was created ad hoc, in response to strong industry pressure and the argument that a competitive U.S. semiconductor industry is essential to national defense.

As an organizing concept, promotion of critical industries could give direction to future government support of commercial technology. Whatever the institution, adequate funding will be critical. ATP is a tiny program in a diverse agency. The overall NIST budget is the same in real terms today as it was two decades ago. Even if NIST's budget doubles in the

Table 2-l—Comparison of National Critical Technologies with Department of Commerce Emerging Technologies and Department of Defense Critical Technologies

National critical technologies	Commercial emerging technologies	Defense critical technologies
Materials		
• Materials synthesis and processing	• Advanced materials	• Composite materials
• Electronic and photonic materials	• Advanced semimconductor devices	• Semimconductor materials and micro-electronic circuits
	. Superconductors	
• Ceramics		• Composite materials
• Composites	• Advanced materials	
• High-performance metals and alloys		
Manufacturing		
• Flexible computer integrated manufacturing	• Flexible computer integrated manufacturing	• Machine intelligence and robotics
• Intelligent processing equipment	• Artificial intelligence	
• Micro- and nanofabrication		
• Systems management technologies		
Information and Communications		
• Software	• High-performance computing	• Software producibility
• Microelectronics and optoelectronics	• Advanced semiconductor devises	• Semiconductor materials and micro-electronic circuits
	• Optoelectronics	• Photonics
• High-performance computing and networking	• High-performance computing	• Parallei computer architectures
	• Digital imaging	• Data fusion
• High-definition imaging and displays	• Sensor technology	• Data fusion
• Sensors and signal processing		• Signal processing
		• Passive sensors
		• Sensitive radars
		• Machine intelligence and robotics
• Data storage and peripherals	• High-density data storage	• Photonics
• Computer simulation and modeling	• High performance computing	• Simulation and modellng
		• Computational fluid dynamics
Biotechnology and Life Sciences		
• Applied molecular biology	. Biotechnology	• Biotechnology materials and processes
• Medical technology	• Medical devises and diagnostics	
Aeronautics and Surface Transportation		
• Aeronautics		• Air-breathing propulsion
• Surface transportation technologies		
Energy and Environment		
• Energy technologies		
• Pollution minimization, remediation, and waste management		
		• No National Critical Technoiogies counterpart: High energy density materials, Hypervelocity projectiles, Pulsed power, signature control, Weapon system environment

SOURCE: U.S. Department of Commerce, *Emerging Technologies: A Survey of Technical and Economic Opportunities,* Spring 1990; and U.S. Department of Defense: *Critical Technologies P/an,* 15 March, 1990; as cited in The National Critical Technologies Panel, *Report of the National Critical Technologies Pane/* (Washington, DC: U.S. Government Printing Office, March 1991), table 2.

next *5 years,* as President Bush has proposed, ATP may not get much of the increase. At its present size ($36 million in fiscal year 1991), ATP is only a beginning. It is not yet adequate for a government-industry technology partnership that is big and broad enough to make a difference to the whole economy. Whether seen as an outgrowth or eventual replacement for ATP, a CTA might well begin small. But a mature program of technology support would probably need to be budgeted at $1 billion to $2 billion per year (see earlier discussion), though it would take time for the agency to develop the staff and experience to manage a program of that size.

If Congress wishes to authorize a critical industries program, it could also take action to give critical industries special priority in other areas of government decision making. For example, in the antitrust area, firms in a critical industry might be extended the same kind of protection for joint

manufacturing or joint production activities that are now given to cooperative R&D activities under the National Cooperative Research and Development Act of 1984. (Special action for critical industries would not be needed if Congress decides to amend the 1984 law along these lines for all industries. Several bills to accomplish this have been proposed in recent Congresses, including S.479 as introduced in the 102d Congress.)

In the same vein, Congress could require Federal agencies to prepare "competitiveness impact evaluations" before promulgating policies likely to have a major adverse impact on the international competitiveness of a designated critical industry. By focusing only on critical industries, the sea of paperwork that might be created by broader impact statement requirements might be avoided.

As noted, strategic competitiveness policy would allow occasional departures from the prevailing free trade philosophy. Such departures would not be frequent, but the ability to take the initiative in matters of trade policy would be a necessary part of the overall strategy. Once critical industries are identified, a special interagency group could be set up to consider trade policy actions that would promote the competitiveness of the industry; the critical industries organization would be responsible for coordinating trade policies with other strategies in support of the selected industries. As mentioned earlier, trade negotiators could be directed to give critical commercial industries top priority in dealings with other countries on fair trade and market access issues. The presence of a competitiveness champion within U.S. Government would strengthen the hand of U.S. negotiators in such dealings.

The most important job for a government body responsible for support of critical commercial industries would be to tie together the policy strands in a reasonably coherent whole. Of course, no government agency can ever establish a neat, wholly coherent policy on any broad national issue, whether it be fiscal policy, health, education, environment, or competitiveness. There will always be some messiness, conflicts and overlap between agencies, struggles between special interests and the national interest, compromise and disarray. Because the U.S. Government and the American people have relatively little experience in government-industry partnerships, it would be overoptimistic to expect the creation of a coherent strategic competitiveness policy to be easy or rapid, even assuming a consensus in support of such a strategy. A modest start and evolutionary growth is a more reasonable expectation. But the aim of coherence would nevertheless have to be steadily pursued. Otherwise, it is too easy to be sidetracked into spreading available resources too thinly, or hijacked into serving special interests.

Institutional Alternatives

Institutional arrangements for developing and implementing a critical commercial industries approach could take many forms. Two possibilities are discussed below.

A Critical Industries Office

A small office in the executive branch with an elite staff could serve as the lead agency in developing and implementing strategic competitiveness policy. The office might be placed in a department, or, in a willing Administration, the Executive Office of the President. In either case, championing critical industry strategies and serving as a catalyst for action by Federal agencies could be part of the office's mandate.

Proposals in recent Congresses to create an office of competitive analysis might be a starting point. As proposed in H.R. 1274, a trade reorganization proposal introduced but not acted on in the 101st Congress, the office would report each year on the competitive prospects of American industries, and could empanel temporary industry councils to advise on needed changes in Federal policy with respect to specific industries. Even if Congress stopped short of trade reorganization, it could direct the Administration to create a critical industries office within an existing department. The Department of Commerce, which now administers several trade and technology programs, might be a logical place.

Locating the office in the Executive Office of the President would be a good option in an Administration that is supportive of the critical industries approach. The Executive Office can bring high visibility and government-wide perspective to issues. However, such a location is likely to be ineffective in an Administration hostile to the concept.

While private industry input would be indispensable, a critical industries office would need a strong

staff. First, the process of identifying critical industries would demand highly competent personnel. An even more demanding task for the staff would be to encourage Federal actions and policies that make a real difference in the competitiveness of critical industries. If Congress were to direct the Administration to set up such an office, it might consider exempting the office from the normal civil service guidelines on hiring and dismissal of employees. To assure fresh thinking, Congress could direct that no more than half of the initial staff could be drawn from existing agency personnel. Congress might also make sure that the agency had the resources to actively recruit from industry, universities, and research institutions.

Government Reorganization and Strategic Industry and Trade Policy

A major change in current government organization for trade and competitiveness policy is not a prerequisite for a critical industries approach. However, the way the government organizes its functions does affect policy outcomes, and competitiveness policy is no exception. If Congress wishes to promote a more proactive approach to trade and competitiveness issues, then reorganization could produce a more focused policymaking apparatus and more direct lines of authority for carrying out the policy.

The current structure for trade decisionmaking within the Federal Government is diffuse, with dozens of agencies having roles to play and a bewildering array of interagency task forces playing coordination functions. No fewer than 10 departments, 2 independent agencies, and 4 executive office agencies take part in trade policy formulation, and the actions of many other agencies and departments can affect international trade. The Commerce, State, Treasury, and Agriculture Departments all powerfully influence trade policy, as do some independent agencies (the International Trade Commission). The U.S. Trade Representative (USTR) has statutory responsibility for trade policy coordination and negotiation, but (as noted) its staff is stretched thin by the issues of the day (e.g., securing a Uruguay Round agreement, launching negotiations for a Mexican Free Trade Agreement).

Responsibility for other government functions affecting the competitiveness of American industry is similarly diffuse. Dozens of agencies have regulatory responsibilities that, in large and small ways, can influence industrial competitiveness. Several agencies-commerce, Defense, Energy, the National Science Foundation-have R&D responsibilities relevant to industry. Efforts to coordinate functions among agencies is predictably sporadic; the White House Office of Science and Technology Policy (OSTP) in the Bush Administration, for example, has breathed life into interagency coordinating committees that a few years earlier had been all but abandoned.

Sprawling, decentralized policy structures may have adequately served the overall strategic interests of the United States throughout most of the post World War II period. Yet the absence of a powerful voice within government for the international competitiveness of American industry almost assures that other objectives (e.g., foreign policy, national security) begin with the stronger hand when disputes arise, whatever the substance of the matter. Moreover, the lack of central focus and direction, far from underpinning the U.S. Government commitment to free trade, has resulted in trade policy with quite a few contradictions and apparent exceptions.

Some in Congress have proposed government reorganization as a means to improve the focus and effectiveness of Federal trade and commercial policy functions. Some bills would establish a new Department of International Trade and Industry, assuming many functions now carried out by the Office of the USTR, the Commerce Department, and some export financing agencies.[88] Other proposals have called for a Department of International Trade and Investment or Department of International Commercial Policy, consolidating USTR and the trade policy units of several existing Departments into one agency, and establishing a cabinet committee to coordinate international economic policy .89

Another set of proposals have called for creation of a Department of Industry and Technology, building on existing Commerce Department authority for export promotion and creating a Civilian Technology Agency.[90] Some proposals to set up an industry and technology department would also create an independent U.S. Trade Administration, comprised of the Office of the USTR and Commerce Department agencies responsible for trade administration and international economic policy .91 (The USTR would continue to serve as a cabinet rank official).

In the end, the specific bureaucratic arrangements outlined in these proposals are less important than the substantive goals they try to achieve. Nor should any of these arrangements be expected to eliminate coordination problems. As a practical matter, not all the Federal agency functions related to competitiveness could ever be consolidated into one department. Many key financial, trade, and technology policy functions would continue to be carried out elsewhere. Moreover, executive office coordination of these functions would still be needed. It is hard to conceive, however, that a coherent competitiveness policy can succeed without a strong agency heading up the effort.

1 Two earlier reports in OTA's assessment of Technology, Innovation and U.S. Trade consider many of these issues in detail. ***Paying the Bill: Manufacturing and Americans Trade Deficit, OTA-ITE-390*** (Springfield, VA: National Technical Information Service, 1988) discusses the place of manufacturing in international trade and the U.S. economy. ***Making Things Better: Competing in Manufmturing, OIYdlT!-443*** (Washington DC: U.S. Government Printing Office, February 1990) considers how technology can improve U.S. manufacturing competitiveness, including four possible areas for government action: the financial environment, human resources, diffusion of technology, and strategic technology policy. Other recent, closely related OTA reports are ***Worher Training: Competing in the New International Economy, OTA-ITE-457*** (Washington, DC: U.S. Government Printing Office, September 1990) and ***Commercializing High Temperature Superconductivity, OTA-ITE-388*** (Washington DC: U.S. Government Printing Office, August 1988).

2 U.S. Congress, Office of Technology Assessment ***Paying the Bill,*** op. cit., passim, and ***Making Things Better,*** ibid., passim; MIT Commission on Productivity, ***Made in America: Regaining the Productive Edge*** (Cambridge, MA: The MIT Press, 1989) passim.

3 The agreement was the 1986 U.S.-Japan Semiconductor trade agreement, renewed with substantial modifications in 1991. U.S. producers' access to the Japanese market (which was informally part of the agreement) has been lower than U.S. companies and negotiators deem acceptable, although U.S. companies' Japanese market shares did improve after the agreement took effect. While there is dispute about whether the agreement ***caused*** higher prices for memory chips, the price hikes that followed the STA also hurt the computer industry. For further explanation of this agreement, see ch. 4.

4 Chalmers Johnson ***MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975*** (Stanford, CA: Stanford University Press, 1982).

5 The discussion below is based on options detailed in ***Making Things Better,*** op. cit., ch. 2, and ***Worker Training,*** op. cit., ch. **2.**

6 From 1977 to 1988, the U.S. cost of capital for investments in machinery and equipment with a physical life of 20 years averaged 3.4 percentage points higher than similar costs in Japan and 4.9 percentage points higher for investments in a factory with a physical life of 40 years. (Robert N. McCauley and Steven A. Zimmer, 'Explaining International Differences in Capital Costs, " ***Federal Reserve Bank of New York Quarterly Review, summer*** **1989,** pp. 7-28.) Although some international differences in capital costs are due to risks related to currency fluctuations, sustained differences of the magnitudes shown by McCauley and Zimmer are unlikely under free market conditions. Despite liberalization in the 1980s, the Japanese financial market is not yet as open as that in the United States. Also, tax incentives and exemptions are widely used in Japan to lower capital costs and promote investment, often in specific industries or technologies. Furthermore, the Japanese system of stable and mutual shareholding means that only a small portion of companies' shares are traded on financial markets, thus relieving pressure on management to show short-term profits. See ***Making Things Better,*** op. cit., ch. 3, for a discussion of the costs of capital and conditions of availability in Japan and the United States.

7 The 1990 budget agreement between Congress and the Administration, which partitions spending into defense, domestic nondefense, and foreign nondefense categories, lasts through three fiscal years, from 1991 through 1993. Afterwards, the three categories may again be merged so that it would be possible, say, to pay for tax expenditures in the non-defense part of the budget with spending cuts in defense.

8 The Joint Committee on Taxation estimated the cost in lost revenues of the investment tax credit at $13 billion to $37 billion per year in the 1980s, and $8 billion to $64 billion per year for the Accelerated Cost Recovery System. Both programs were ended in the tax reform law of 1986, in favor of an overall reduction in the corporate tax rate (although certain classes of assets are still granted fast depreciation).

9 These policy options for training of active workers are drawn from the OTA report ***Worker Training,*** op. cit., ch. 2.

10 A bill to setup such a program, Section 404 of S. 2114, was introduced in the 101st Congress.

11 For a detailed discussion of these options, see ***Making Things Better,*** op. cit., pp. 53-71. Descriptive and analytic material on technology diffusion in the United States and other countries is in chapters 6 and 7 of that report.

12 Fewer States applied for the Centers opening in 1991 than for those beginning 2 years earlier (20 proposals compared with 36). "Commerce Selects Two Manufacturing Centers," New ***Technology Week, Mar.*** 11, 1991. A smattering of other Federal programs offer some technology extension services. The largest of these is Trade Adjustment Assistance for firms, which has been funded at about $9 million per year in recent years.

13 ***Making Things Better,*** op. cit., p. 58.

14 This is direct government loans only and does not count loan guarantees, which are about twice as great. In 1987, direct loans to small and medium enterprises from the three main government financing institutions amounted to Y3.8 trillion ($30 billion at Y125 to the dollar); loans guaranteed by the 52 nationwide credit associations amounted to Y7.8 trillion ($62 billion). D. H. Whittaker, "New Technology Acquisition in Small Japanese Enterprises: Government Assistance and Private Initiative," contract report to the Office of Technology Assessment, May 1989.

15 See ***Making Things Better,*** op. cit., pp. 192-194.

16 On Mar. 1, 1991, DOE signed an agreement with Martin Marietta Energy Systems, which runs Oak Ridge National Laboratory, for a class waiver on inventions proposed by Martin Marietta for commercialization (subject to national security exceptions). Class waivers had previously been granted only to non-profit operators of DOE's national labs; this was the first such agreement with a for-profit operator. Paul Kemezis, "Oak Ridge Lab Receives Approval to Sign Deals With U.S. Industry, " New ***Technology Week, Mar.*** 11, 1991.

17 For example, the National Center for Manufacturing Sciences organizes shopping trips to the labs on behalf of its over 100 industry members, seeking to pair lab expertise with industry needs. This complements a longer established effort from the labs' side, the Federal Laboratory Consortium, which operates a small core staff and 300 volunteers from the labs to match inquiries from firms with the appropriate lab researcher.

18 See ***McGraw-Hill's Tech Transfer Report,*** February 1991, for several recent examples.

19 Ibid.

20 Bill Loveless & David Kramer, "Expanded Missions Eyed for DOE's National Labs,' ***McGraw-Hill's Tech Transfer Report,*** February 1991, p. 13.

21 Software written in contractor-operated Federal labs can be copyrighted and then licensed to firms. An exclusive license is sometimes a necessary incentive for a firm to commercialize the software. However, software written in government-operated labs is written by government employees and cannot now be copyrighted, making it difficult or impossible to grant firms exclusive rights.

22 The National Cooperative Research Act of 1984 lessened the legal risks of joint R&D. See P.L. 98-462, 15 U.S.C. 43014305.

23 Malcolm Baldrige National Quality Improvement Act of 1987, Public Law **100-107, Sec. 3.**

24 Jeremy Main "How to Win the Baldrige Award, " ***Fortune,*** Apr. 23, 1990, p. 101.

25 Ibid.

26 These categories are drawn from the report of a private group, the Council on Competitiveness; see ***Gaining New Ground: Technology Priorities for Americans Future*** (Washington, DC: The Council, **1991). The** government reports include U.S. Department of Commerce, Technology Administration, ***Emerging Technologies: A Survey of Technical and Economic Opportunities*** (Washington, DC: Department of Commerce, 1990); U.S. Department of Defense, ***Critical Technologies Plan,*** report for the Committees on Armed Services, U.S. Congress, AD-A234-900 (May 1, 1991); Government of Japan, Ministry of International Trade and Industry, ***Trade and Future Tusks in Industrial Technology (Sangyo Gijutsu no Doko to Kadai)*** (Tokyo: **1988);** Commission of the European Community, ***First Report on the State of Science and Technology in Europe*** (Brussels: 1988).

27 The program began in October 1988. U.S. Congress, Office of Technology Assessment, ***Making Things Better,*** op. cit., p. **188, box** 7-B.

28 Foreign market barriers, their effect on U.S. industry, and the U.S. response are discussed in more detail in ch. 4. In addition, barriers imposed by the EC, Japam Korea and Taiwan are discussed in chs. 5-7.

29 Clyde V. Prestowitz, Jr., Alan Tonelsom and Robert W. Jerome, "The Last Gasp of GATTism, ' ***Harvard Business Review,*** March-April 1991, p. 137.

30 See box 4-A. In the GATT Uruguay Round, Canada and the EC have proposed transforming GATT into an ITO; consideration of this proposal has been deferred until after the Round is completed.

31 19 U.S.C. 2411-2420.

32 This is the pot calling the kettle black. Many countries consider their laws superior to GATT when they deem it necessary.

33 This case is discussed in detail inch. 4.

34 Clyde V. Prestowitz, Jr., ***Trading Places: How We Allowed Japan To Take The Lead (New*** York NY: Basic Books, 1988), pp. 283, 50-52.

35 Ibid., pp. 276-277.

36 Protection can be granted in certain other cases-for example, under Section 201, as described below. Protection has also at times been instituted by means of bilateral agreements limiting the quantity of imports of certain products from particular countries. Examples are textiles, machine tools, and automobiles. Except for textiles, in which the bilateral agreements come under an overall arrangement sanctioned by GATT these bilateral agreements at least arguably violate GATT Protection against imports is discussed in detail in ch. 4.

37 19 U.S.C. 2251-2254.

38 19 U.S.C. 2253(a)(3).

39 From 1980 through 1990, U.S. industry petitioned for relief under Section 201 20 times. The required injury was found in seven cases (though in two only for some of the products at issue), and the U.S. industry received some protection in five (see table 4-8).

40 19 U.S.C. 2252(b)(l)(B).

41 GATT's escape clause (Article XIX) requires injury "to domestic producers . . . of like or directly competitive products, ' and U.S. law tracks this language (19 U.S.C. 2251). In contrast, GATT's provisions regarding subsidies and dumping (Article VI) permit a showing that the dumping or subsidization "retard[s] materially the establishment of a domestic industry," and U.S. law follows that language (19 U.S.C. 1671(a)(2), 1673(2)).

42 The language of GATT's escape clause is general, requiring only that the increased imports "cause or threaten serious injury to domestic producers. . . of like or directly competitive products. ' There has been little interpretation of this language by GATT dispute resolution panels. Negotiations underway in the Uruguay Round could clarify the escape clause's scope. The United States seeks to restrict rather than expand this scope.

43 GATT Article XIX, par. l(a).

44 At times protection could also be justified under GATT's national security exception (Article XXXVIII). This could be the case, for example, with protection of the domestic semiconductor industry, which furnishes the U.S. military with essential components of weapons. However, the United States and other countries have been cautious about using that exception for fear of setting precedents that would make it into an all-purpose tool to justify a great deal of protection.

45 In the time it takes to reach this point the U.S. industry's condition might improve enough so that it could get along without protection.

46 The terms of the EC proposal to the Japanese on automobiles had not been made public at this writing; this description is based on information from trade sources.

47 U.S. Commerce Department International Trade Adrministration, Office of Management personal communication, Aug. 2, 1991.

48 U.S. General Accounting Office, ***Export Promotion: Problems in Commerce's Programs, NSIAD-89-44*** (Gaithersburg, MD: U.S. General Accounting Office, 1989), p. 17.

49 The Japanese effort included 3 officers at the Japanese embassy and 78 employees of the Japan External Trade Organization (JETRO), an agency of MITI. Those figures are from Akemi Yoshida, Attaché in Management and Coordination, Japanese Embassy, Washington DC, Aug. 21, 1991; and Hiro Sate, Director of Research JETRO (New York Office), Aug. 21, 1991. The figures for U.S. staffing in Japan are from an interview with Ed Stumpf, Director, East Asia and Pacific, USFCS, Aug. 21, 1991.

50 United States Trade and Development Program, 1990 Annual Report, pp. 27, 29, 55-61.

51 H.R. 2508 and S. 1435, in conferences of August 1991, would do both.

52 50 U.S.C. App. 2401-2420. This Act's authorization lapsed as of Oct. 1, 1990, but President Bush continued its provisions in force by invoking the International Emergency Economic Powers Act 50 U.S.C. 1702. See executive order 12730-Continuation of Export Control Regulations, Sept. 30, 1990.

53 Public Law 100-418, sec. 2414, codified at 50 U.S.C. App. 2504(a)(5).

54 Title II of the Omnibus Trade and Competitiveness Act of 1988, Public Law 100-418.

55 50 U.S.C. App. 2409(g).

56 S. 320 passed the Senate on Feb. 20, 1991, and was referred jointly to the House Committee on Foreign Affairs and the House Committee on the Judiciary on Feb. 26, 1991. This bill resembles the conference version of H.R. 101-4653 and S. 101-2927, as passed by the House and Senate in 1990, but omits certain provisions that President Bush found objectionable in vetoing that bill. See President George Bush, Memorandum of Disapproval for the Omnibus Export Amendments Act of 1990, Nov. 16, 1990.

57 S. 320, Sec. 117.

58 A 1990 conference report on this same provision commented

that "[s]ome provisions of the 1988 amendment to the EAA were not implemented or were implemented far beyond statutory deadlines. " H. Rept, 101-944, p. 75.

59 50 U.S.C. App. 2409(j).

60 S. 320, Sec. 124.

61 50 U.S.C. App. 2402(f)(3)(B).

62 This was proposed in H.R. 4653, Sec. 120, but deleted in conference. See House Conference Report 101-944 (on H. 4653), p. 75.

63 Dual-use nuclear technology comes primarily under another statute, Section 309(c) of the Nuclear Non-Proliferation Act of 1978, codified at 42 U.S.C. 2139a(b). See Section 17(d) of the EAA, at 50 U.S.C. App. 2416(d).

64 ***See Making Things Better,*** op. cit., especially pp. 71-89.

65 ***Budget of the United States Government: Fiscal Year 1992,*** part two, p. 47.

66 For more detailed discussion ***see Making Things Better,*** op. cit., pp. 71-79.

67 One of the bills, S. 1233 in the 100th Cong., was reported out of the Senate Committee on Governmental Affairs, attached to the 1988 trade act, but was then dropped. Two similar bills, H.R. 3838 and S. 1978 were introduced in the 10lst Cong.

68 U.S.-owned companies are defined as those that have majority ownership or control by citizens of the United States.

69 U.S. Congress, House of Representatives, ***Conference Report*** [to accompany H.R. 5021] making appropriations for the Departments of Commerce, Justice and State, the Judiciary, and related agencies for the fiscal year ending Sept. 30, 1991, and for other purposes, report 101-909, Oct. 20, 1990, pp. 25-26.

70 These comparisons are for merchant producers, who sell semiconductors on the open market. Companies that produce only for their own use (captive production) are excluded; IBM the world's biggest producer, is in this category and therefore excluded. All major Japanese producers are included.

71 In practice, capital-intensive and R&D-intensive industries tend to get more benefits than others from the tax incentives.

72 A succinct description and evaluation of the postwar RFC is in Arthur T. Denzau and Clifford M. Hardin, "A National Development Bank: Ghost of the RFC Past," formal publication number 62, Center for the Study of American Business, June 1984.

73 ***A Strategic Indusrtry at Risk,*** a report to the President and the Congress from the National Advisory Committee on Semiconductors (Washington DC: The Committee, 1989), p. 20. See ***also Making Things Better,*** op. cit., pp. 80-89.

74 Recent data have been classified by the U.S. Government. Estimates based on detailed data are publicly available only for 1981, the Code's first year of operation. In that year, the Code was estimated to have covered only $18 billion in U.S. procurement and $4.2 billion in all foreign procurement combined. (For comparison in 1985 U.S. procurement, and procurement by all other Code signatories, each totaled in the range of $200 billion.) The amount of actual trade under the Code in 1981 appeared to be much smaller+ 3.3 billion for U.S. imports and **$270 million in U.S. exports. And the amount of this trade that would** not have occurred without the Code appeared to be at most $210 million for U.S. imports and perhaps substantially less than $270 million for U.S. exports. (See ch. 4.)

75 Public Law 100-418, Title VII.

76 U.S. Department of Commerce, Bureau of Economic Analysis. BEA breaks this down as follows: defense goods, $96.7 billion defense services, $84.8 billion nondefense goods, $10.3 billion nondefense services, $37.8 billion. (Procurement of services does not include compensation paid to employees.)

77 To get this result, proportion estimates that area few years old are applied to the 1990 figures. Based on testimony in 1989, the Code covers about 10 percent of total Federal procurement. W. Douglas Newkirk, Assistant U.S. Trade Representative for GATT Affairs, Office of the United States Trade Representative, testimony at hearings before the House Committee on Government Operations, Subcommittee on Legislation and National Security, Sept. 27, 1989, p. 6 (p. 56 of hearing print). Based on GAO testimony in 1989, describing procurement during 1985 through 1987, Code-covered procurement is split roughly 80 percent for DoD and 20 percent for other agencies. Adam Cowled, Senior Evaluator, U.S. General Accounting Office, personal communication, July 24, 1990, interpreting U.S. Congress, House Committee on Government Operations, ***International Procurement and Waivers of the Buy America Act: U.S. Business at a Disadvantage,*** H. Rept. 101-989, Nov. 29, 1990, p. 7 fn. 6, and Allan I. Mendelowitz Director, Trade, Energy and Financial Issues, United States General Accounting Office, testimony at hearings before the House Subcommittee on Legislation and National Security, Sept. 27, 1989, p. 30 of Committee print. Thus, in 1990 about 8 percent of $229.6 billion, or $18.4 billion, is Code-covered defense procurement, while about 2 percent of $229.6 billion, or $4.6 billion, is Code-covered nondefense procurement.

78 Probably roughly 50 percent of defense procurement, or $90.8 billion, is covered by MOUs (ch. 4). Perhaps about $18,4 billion of defense spending is covered under the Procurement Code (see previous footnote). Assuming that there is no overlap between Code and MOU coverage (which yields the highest possible figure), the combined coverage is $90.8 billion plus $18.4 billion, or $109.2 billion.

79 The Procurement Code covers only goods and services "incidental" to the purchase of goods. Even if all $4,6 billion of the Code-covered nondefense procurement is for goods, that still leaves $5.7 billion in non-Code-covered nondefense procurement, since the total nondefense procurement of goods is $10.3 billion (see first footnote in this paragraph).

80 Defense procurement for 1990 consisted of $96.7 billion for goods and $84.8 billion for services (see first footnote in this paragraph). While the $18.4 billion of Code-covered defense procurement is likely almost all goods (see previous footnote), it is hard to tell how the $90.8 of MOU-covered procurement is divided between goods and services. If it were divided proportionately to the total spent on defense goods versus services, $48.4 billion would be for goods. This yields a total of at most (assuming no overlap between Code and MOU coverage) $18.4 billion **@ts $48.4 billion** or **$66.8** billion in defense goods covered by the Code or MOUs, leaving at least $29.9 billion of uncovered defense goods.

81 Other countries could argue that such actions violate the GATT Procurement Code, Article IV, which states that "[technical specifications. . shall not be prepared, adopted or applied with a view to creating obstacles to international trade nor have the effect of creating unnecessary obstacles to international trade." However, the point is debatable, especially if the specifications are shaped merely to be convenient for U.S. firms rather than to deliberately be inconvenient for foreign firms.

82 This estimate is based on Commerce Department data for State and local purchases of durable goods in 1990 ($33 billion) and the percentage of such purchases going for motor vehicles in 1982 (24 percent at that time-no more recent figure is available).

83 However, the EC has taken the position that if the Procurement Code's coverage is expanded State and local government procurements in the United States should be covered.

84 The Competitiveness Policy Council (CPC) was established by the 1988 trade act (Public Law 100-418) but did not get underway until early 1991. Its members are appointed by the President and by Senate and House leaders from both parties; it is to report annually to the President and Congress. It should not be confused with the nonstatutory Council on Competitiveness in the office of Vice President Quayle, which evaluates the impact of Federal regulation on competitiveness, or the private Council on Competitiveness. Congress will need to act if the CPC is to continue; the Bush Administration's proposed budget says that the Council will complete its work in 1991 and disband in 1992, with Vice President Quayle's competitiveness council assuming responsibil-

ity for regulatory and "other" competitiveness issues. To date, the Vice President's council has not shown evidence of a willingness to address the broad range of issues assigned to the CPC.

85 Also broadly similar are lists of critical technologies developed by the Japanese Ministry of International Trade and Industry and the Commission of the European Community.

86 Technology Administration, U.S. Department of Commerce, ***Emerging Technologies: A Survey of Technical and Economic Opportunities*** (Washington DC: U.S. Department of Commerce, spring 1990).

87 NationaI Advisory Committee on Semiconductors, ***Toward A National Semiconductor Strategy,*** 2d annual report, N.A.C.S., Arlington, VA, February,1991, p. 15.

88 Bills to establish a Department of International Trade and Industry include, among others, S.121 as reported by the Senate Committee on Governmental Affairs in the 98th Cong.; S. 1365 as introduced in the 99th Cong.; H.R. 1338 and H.R. 2135 as introduced in the 100th Cong., and H.R. 1274 as introduced in the 101st Cong.

89 For an analysis of this approach see Stephen D. Cohen ***The Making of United States International Economic Policy: Principles, Problems and Proposals for Reform (New York NY:*** Praeger, 1988), pp. 248-271

90 See S.1978, the proposed Trade and Technology Promotion Act of 1989, as introduced in the 101st Cong. and S.1233, the proposed Economic Competitiveness, International Trade and Technology Development Act of 1987, as reported by the Senate Committee on Governmental Affairs on June 23, 1987. (Senate Report 100-82)

91 S.1233 (100th Cong.) as reported by the Senate Committee on Governmental Affairs on June 23, 1987. See S. Rept. 100-82 for discussion.