Benefits of Cooperative Effort

Collaborative arrangements improve innovation exchange, but broader sweep is necessary

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Since technological innovation and cooperative R&D are critically important issues and are interrelated, I will discuss them in the context of collaboration for expanding innovation. As background, I should note that the United States is not adequately responding to the challenges of foreign competition. Seventy percent of our domestic market is accessible by other countries and we are being beaten in many industries, especially by the Japanese. Tomorrow, we will be beaten even worse by Japan and the little Japans that are emerging unless we respond aggressively, quickly and most important, efficiently.

One obvious and necessary action to compete with the lower cost of foreign labor is to invest in more robotic equipment to improve productivity in the factory, and in more computer and telecommunication equipment to improve the productivity of the services sector. A surge in capital equipment investment, however, will further aggravate an already serious unemployment problem. Therefore, we must simultaneously address the issues of improving productivity to better compete with our existing products and services and to expand the development and production of new products and services to create more jobs.

One of the characteristics of the Japanese society that works for them and against us is the propensity for consensus seeking and the tradition of cooperation in developing and exploiting base technologies in selected industries. As a consequence, they are far more efficient than we are, because in our society cooperation is lagging. For example, there is not nearly enough cooperation within industry and between industry and academia. As for the relationship between business and government, it's been more adversarial than cooperative, especially at the federal level. The place where the most cooperation is taking place today is at state-community-neighborhood levels. But even here, participation by business, academia and government in cooperative programs is far short of what is required to improve productivity and at the same time create the large numbers of badly needed new jobs.

We must change into a mode of cooperation to the fullest possible extent in order to most efficiently use our scarce resources to meet those objectives—not by trying to emulate the Japanese system, but by doing it within our own culture in our way. Our efforts to work together must include technological cooperation among large companies, among industry, universities and government, between large and small companies, and at the community level among all sectors. In addition, states should form regional organizations to promote technological cooperation among themselves and with foreign countries. I will elaborate on each area.

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LARGE COMPANIES

Beginning with large companies. It is important to emphasize that we should not only encourage increased cooperation in research, but also strive toward cooperation which is in support of competition. A properly constituted cooperative research venture represents cooperation *now* in support of enhanced competitive performance *in the future.* Let me be more specific and turn to the myriad U.S. industries that can be characterized in at least several of the following ways:

—Rapid technological advance.

—Growing costs of assaulting each succeeding scientific and technological barrier to progress (the bet-your-company syndrome).

—Shortage of skilled research-oriented personnel.

—Insufficiency of research facilities.

—Too little research to support reasonable scientific and technological progress.

—Substantial and growing competition from non-U.S. firms in both U.S. and other markets.

Far more industries than you may at first recognize display at least three or four of these attributes and thus are candidates for establishment of a cooperative research venture. It should also be noted, however, that a high degree of reliance on science and technology by an industry is neither a necessary nor sufficient condition for the proper establishment of a cooperative research venture.

To further put matters in perspective, we should note that the decline of U.S. post-World War II market dominance in many industrial areas was inevitable. First, the rapid rise of the international enterprise catalyzed the process. Second, the unprecedented open attitude of the U.S. government and the U.S. science establishment contributed materially to the international diffusion of scientific achievements. Third, the U.S. institutions of higher learning welcomed, even sought, students from around the world. Finally, of course, certain nations, most notably Japan, were able to concentrate disproportionate resources on exploiting scientific outcomes through market-oriented innovations because they were significantly relieved of the necessity to pursue science on their own, given the openness of the U.S. research programs and results.

The U.S. benefitted materially from its science and technology transfer programs and activities for perhaps

20 or 25 years following the end of World War II. Moreover, we probably could have continued along this path without jeopardy but for two "failures" of our own policies, both public and private. First, the U.S. was increasingly wasting the resources necessary for research and development through the growing needless duplication of efforts, especially with regard to basic and applied research. This was due importantly, though not exclusively, to poorly thought-out antitrust attitudes and laws. Second, U.S. firms failed to acquire the rights to the technologies and techniques developed overseas on the basis of U.S. science, as a quid pro quo for the transfers.

But the stage is set for change. At last the U.S. is coming alive to at least *some* of the problems it faces with regard to U.S. competitiveness. One of the principal manifestations of this awareness is the mounting interest within both U.S. industry and government in *cooperative research ventures.* Properly constituted, such a venture is a joint activity which allows firms to share *research* results that they can then individually apply to new products, processes, and services for markets of their own choice. A cooperative research venture can obviously cut the costs of certain types of research and thereby free resources to expand the technological possibilities available to the participating firms and to its licensees. It is this latter result that can have the most dramatic effect on progress—measured both through gains in U.S. productivity and greater international competitiveness.

Needless Waste

Avoiding the waste of R&D resources caused by the needless duplication of research is another common underpinning of cooperative research ventures. As earlier stressed, market competition should and must be preserved between firms participating in cooperative research ventures. But the preservation of such market competition does *not* require that each firm be encouraged to devote its independent and separate resources to every research task at hand. Generally, if the frontiers of science and technology that underlie an industry's products and services can be expanded more quickly and economically, those innovative and competitive products and services that generate both public and private benefits will emerge in profusion—and do so more efficiently.

In this connection, with regard to research outcomes, let me comment briefly about the Microelectronics and Computer Technology Corporation (MCC), the first of the new wave of cooperative research ventures. MCC was launched in 1981 and presently has 19 participating companies. Control Data is one of them and the benefits to us in terms of the availability of research results will be significant. More specifically, we have calculated that our commitment of $14 million to several MCC research programs will give us over a three-year period access to research results of interest costing some $119 million. That's not a bad bargain for us—and for the nation, when you consider that other shareholders are gaining similar advantages.

Let me elaborate just a bit on conversion of research outcomes into competitive products. Cooperative research ventures in general should properly be confined to the research end of the process of innovation. The research results and technological possibilities emanating from research cooperation should be exploited by individual firms that carry out product development, production, and marketing in competitive rather than cooperative environments. The Japanese electronics industry has adopted this strategy with great success, to cite but one example.

The availability of the research results of cooperative research ventures is a crucial issue. And it has broad implications for both public and private policy. Cooperative research ventures certainly must make their research results available to participants in a timely, efficient manner. But, in my view, they should also be required to license such outcomes to others, after sponsors have enjoyed a suitable lead time (three years is about right for most industries) and, of course, such research results and technologies should command a fair price from nonparticipating licensees.

Equally important, cooperative research ventures should be encouraged to make a special effort to provide their research results to small enterprises. As I will later emphasize, small business in the United States is an especially important source of innovations. This is not to say that large firms—the sorts of entities primarily supporting cooperative research ventures—are unnecessary to generate innovations. It is rather that small firms are critical to the maintenance of U.S. innovative performance across a broad industrial front.

Often, for example, the small enterprise can justify the earlier introduction of a new product or service because the potential returns relative to the size and investment of the firm are so much greater than is the case for its larger competitors. In this way, and others, the small business community provides long-run benefits to all who participate in such markets through the competitive spur it provides and the ever-improving products and services that result. Larger firms also benefit from the early testing of the market acceptance of innovations; they can then concentrate on improving the products which result and expanding the markets for them.

Importantly, because of its new-found interest in what is being referred to as "United States competitiveness," the federal government, including Congress, is showing mounting support for the encouragement—rather than discouragement—of cooperative research ventures. Such support is both timely and crucial to the establishment of pro-competitive research cooperation. At present, Congress is about to pass legislation that clarifies and balances antitrust laws to encourage the formation of cooperative research ventures.

UNIVERSITY-INDUSTRY-GOVERNMENT

A close linking of university, industry and government is, of course, another essential underpinning for expanding innovation—to more efficiently create and transfer new knowledge and to better train more people.

Critical U.S. shortages of scientific and technical personnel and inadequate laboratory facilities and instrumentation in universities, have all been well documented.

An exemplary model of industry-university-government cooperation addressing these problems is the Microelectronics and Information Sciences Center at the University of Minnesota. The center, founded in 1980, has an initial funding of $6 million by industry and there will be more to follow. In addition, last year the State of Minnesota appropriated $1.3 million in funding, and the center is receiving federal research grants. The center did not have to make the usual huge investment in laboratory and processing facilities because it has access to facilities in industry that represent an additional investment of more than $100 million. Thus, scarce research dollars are not diluted by the cost of duplicate huge facilities or salaries for operating personnel, who are in critically short supply.

The center will greatly expand work/study programs by providing more instruction at work. Computer-based education will play an important role in helping to deliver instruction and administer examinations, thereby avoiding additional burdens on the faculty caused by the remoteness of the students from the university.

Even though a major part of the industry funding is provided by big business, another important and essential aspect of the program is that others, especially small enterprises, will have access to the results of the R&D. It is contemplated that many new companies will be spawned.

The final point to be made about the center is that there are strong beliefs by both industry and university participants that academic integrity and the cooperative advancement and application of technologies are compatible.

SMALL AND LARGE COMPANY COOPERATION

In order to fully appreciate the enormous potential of greatly increased cooperation between large and small business, it is necessary to review a few more relevant factors about both. First, small business is uniquely important in American society. It was the foundation on which our country was built and achieved greatness. It still is the primary means for encouraging and rewarding individual initiative. And it provides more products, services and jobs, relative to our GNP, than does small business in any other country. Second, studies show that during the last decade small firms generated a high percentage of all new jobs. Third, studies also show that small companies produce 24 times more innovations per dollar than larger ones, and they produce two and one-half times more innovation per employee than large companies. Fourth, we have a well-developed securities market where equity capital can be raised by small entrepreneurs. It is unique to America. And fifth, with respect to big business, is that in addition to the prodigious amounts of unused and underutilized technology in their laboratories, large companies have contingent assets in the form of underemployed management and professional personnel.

By making available its underused technology, and by offering its professional and management assistance to a small company, a large company can realize additional income from past investment. And, through equity investments in and R&D contracts with small companies, large companies can gain more economical access to new products and markets. Four years ago, my company started making equity investments in small companies, many of which are now developing products and services that will be marketed by Control Data. In fact, quite a few of those products and services were developed by the small companies using Control Data technology.

Such programs accentuate the strongest attributes of both large and small enterprise. To further elaborate on the advantages of small companies it should be noted that they are inherently more creative and flexible, with lower overhead. Hence, they can frequently develop new products and services sooner for less cost. But larger companies, with greater resources, can provide efficiencies in production and marketing.

The potential of cooperation between large and small business can hardly be overemphasized. Since this opportunity is not as readily available to other countries, we must capitalize on it, just as other countries, especially the Japanese, capitalize on the unique attributes of their culture. But cooperation won't happen unless there is a widespread dedicated effort focused on that objective. In response to that need and the accompanying business opportunity, Control Data has developed numerous services to facilitate the process of large companies, universities and government laboratories working with small companies. Today I will elaborate on just two of them: Quest for Technology and Business & Technology Centers.

QUEST FOR TECHNOLOGY

Quest for Technology, or QFT, as the name suggests, is a process to facilitate identification of technologies with commercial potential in the laboratories of business, academia and government. Quests are conducted by a team of professional and executive personnel from appropriate fields. Promising technologies are listed by Technotec, a data base of technologies available for commercialization or technologies wanted. Often just the listing process will match an entrepreneur seeking to start a company with an appropriate technology. QFTs are in process at eight universities and several corporations, and interest is growing.

BUSINESS & TECHNOLOGIES CENTERS

Our business and technology centers provide various combinations of consulting services; shared laboratory, manufacturing and office facilities; and other services to facilitate the start up and growth of small businesses. Economies of scale make it possible to provide occupants of the centers with needed facilities and services of much higher quality and considerably lower cost than any would be capable of obtaining or providing for itself.

Control Data is also assisting small business by fostering public/private cooperation at the community level. More specifically, we are helping to launch and have been participating in the operation of community-based organizations with those objectives. I will describe two types: A cooperation office for small business and a seed capital fund.

Cooperation Office

A Cooperation Office fosters the startup and profitable growth of small businesses. It is a nonprofit corporation financed during the early years by contributions and grants with the expectation that the organization will eventually become self-supporting from client fees and funds generated by investments in client companies.

A Cooperation Office's board of directors consists of leaders from all major sectors of society. The approach is simple: An entrepreneur has an idea for a new product or service and wants to start a company. The Cooperation Office helps develop a business plan and obtain financing.

The permanent staff is small, but the Cooperation Office draws on a volunteer advisory panel of engineers, scientists and executives for the specific expertise required to evaluate and help prepare business plans. Because these plans are expertly conceived, the chances of receiving adequate financing and achieving economic viability are substantially increased.

Seed Capital Fund

Seed capital is often not available for new companies during their initial formation and early development stages from more conventional sources such as venture capital companies and banks. Perhaps I should elaborate on the differences between seed capital and venture capital, or as some say, adventure capital vs. venture capital. Sometimes it is called "angel money," and there are those who suggest that the most appropriate source for seed capital is your mother-in-law. It's no joke, however, to raise seed capital for a start-up company, because most venture capital funds will only invest in a proven product or service and proven managers. In other words, they usually don't want to finance the development of a technology or to support an entrepreneur who has never managed a business—and most haven't.

Because of these realities, a seed capital fund is needed. The first one, the Minnesota Seed Capital Fund, was founded in 1979. It is receiving growing support. Recently, three pension funds became investors, and several more are considering investment.

Job Creation Network

The Cooperation Office, the seed fund, and the BTC described a moment ago constitute what is called a Network for Job Creation, which provides the support needed by small enterprises to become successful. Unfortunately, in our present economic system, such assistance is left too much to chance, with an undue burden on the entrepreneur. As a consequence, a high percentage of new businesses fail. On the other hand, through expanded initiatives and cooperation among industry, government and universities, the necessary support can be provided to vastly increase the success rate for new enterprises. The network is being widely replicated.

To stimulate the participation by business and industry in job creation, another program has also been devised called Start-A-Company. It has the objective of facilitating the process whereby well established companies assist in the start up of small enterprises. Assistance takes the form of technology spinoff, management and professional consulting and/or equity investments.

The first program was launched in Minnestoa last May. It is planned that larger companies in Minnesota will assist in the start up of two companies each and that smaller companies will assist in the start up of one company each. Thirty-three companies have committed to participate. Also, nine University of Minnesota senior faculty members are assisting in identifying and transferring technologies to help get small companies started. Thus far, seven companies have been launched and many more are planned.

A final point to mention is that all types of companies can participate successfully—not just manufacturing companies, but also banks, insurance companies, retail companies, utilities, law firms, public accounting branch offices, and so on.

Institutionalizing Innovation

There is one other function of a job creation network that merits mention. It can help people gain a better understanding of the critically important role of technology in society, especially the fact that most new jobs result from the application of technology by the process of innovation. Most people do not know where jobs originate, nor how terribly difficult it is to create them. That low level of understanding can easily accommodate the belief that the stork brings jobs, although in the U.S. the stork has been preoccupied with the more traditionally prescribed role.

A network in a community provides a perspective on job creation that can be widely understood because of local participation in the process. In other words, this is the way that the culture of technology must be implanted at the grass roots of society, because otherwise experience shows that most people won't become involved and assume their share of the responsibility for creating the jobs so badly needed.

LEGISLATION

Getting support for a job creation network is a long, hard process. In fact, financial incentives are needed to stimulate the required level of support. Last year Minnesota passed legislation to encourage support for job creation networks. Briefly, it provides:

- A 50% tax credit for contributing to cooperation offices.
- A 30% tax credit for investments in new small companies, up to a maximum of $100,000.
- And a tax credit equal to 30% of the value of technology transferred by large companies to small businesses.

Let me elaborate on the reasons for these incentives. A major one is that, frankly, too many of our leaders in business, government, academia, foundations, labor and the religious community are simply unwilling or unable to face up to the seriousness of our problems. Too often it's everything as usual, with little inclination to make the changes and the effort necessary for significant moves in new directions. As a consequence, the difficult process of job creation is often made even more difficult and takes twice as long as necessary. In some communities, it isn't even possible to get the cooperation and support required for an effective job creation program.

Five years have passed since we began the effort to establish the first cooperation office in Minnesota. Raising the necessary funds was a challenging exercise. The concept was new and unemployment at that time in Minnesota wasn't nearly as high as it is today. Even after gaining acceptance of the merits, it was still necessary to overcome the barrier of established patterns for charitable contributions, which are hard to change.

And, in spite of demonstrated success, it continues to be difficult to obtain adequate funding for the Minnesota cooperation office. That's the reason for the legislation granting a 50% tax credit for a contribution to a cooperation office or a similar type of organization. Incidentally, this same type of incentive is available in Pennsylvania and Indiana.

Establishing a seed capital fund is also difficult. Like a cooperation office, it requires dedication and arm twisting. Again, the reason for the Minnesota state tax credits for investments in new business start ups.

Another problem is to convince executives in well-established businesses of the merits of assisting in the start up of small enterprises. Earlier, I mentioned that 33 companies are participating in the Start-A-Company program. On the surface, this appears good—and, everything considered, it is—except it has taken four years to gain the understanding necessary to get this level of participation, which has come about through urging their support for the cooperation office and the seed fund, and the track records of success which both are building. Hopefully, tax credits for technology transfer and investment will help stimulate more attention to the potential of cooperation with small businesses.

REGIONAL APPROACH

Now let me move from community cooperation to describe a regional approach for promoting technological cooperation among individual states and between those states and foreign countries. A major objective of the approach is to establish a system that will foster increased technological cooperation and equitable technology exchange between a region of the U.S. and foreign countries. For reasons to be discussed later, Japan and Great Britian should be the first foreign countries targeted. Implementation can occur simultaneously and independently with each country.

Before providing a few highlights about the approach, I should also mention that the states that have been tentatively selected for a regional group are the members of the Midwest Governors Conference. A steering committee consisting of representatives from each of these states has been formed. It is chaired by Minnesota Governor Rudy Perpich. The steering committee will consider and recommend policies and the type of organizational structure to implement the program.

Japan

A major reason for selecting Japan for a regional program is simply that our federal government lacks the leadership and ability to achieve a consensus on solving the extremely serious problems in technology and trade with that country. A regional grouping of states in a public/private technology and trade consortium, however, can devise the necessary actions and marshall the support needed to effectively address them. Such a consortium could move faster and more flexibly than the U.S. as a whole, while bringing a critical mass to bear that no single state can achieve alone.

The most significant problem is that access by the United States to Japanese technology is pitifully small compared to the technology access that the U.S. provides to Japan. Research results from Japan are less accessible by other countries than from any other noncommunist country. Most research in the U.S. is performed in universities and is accessible by other countries through the movement of graduate students, the widespread licensing of research results, and the practice of open publication of research results. In contrast, much of Japan's research is carried out in government laboratories and private companies whose laboratories are closed to American corporations. Thus, transfers of technology between the U.S. and Japan are heavily imbalanced in Japan's favor.

Furthermore, Japanese companies frequently obtain licenses for advanced technology developed in this country at low costs which inadequately reflect the cost of the technology, the risks assumed in its pursuit, or the time it takes to perfect it. This is particularly true of licenses obtained from universities and small companies. In contrast to the open flow of low-priced technology from the U.S. to Japan, all advanced technology licenses flowing from Japan require approval by the Ministry of International Trade and Industry (MITI), which allows no bargains.

Cornerstones of the regional approach are equitable bilateral technology exchange, technological cooperation among states and between the region and Japan, and equitable bilateral trade agreements between the region and Japan. Trade agreements normally should follow after technology exchanges and results from cooperative projects.

Projects for Cooperation

Cooperative projects should be selected which normally would not be undertaken by industrial firms because of high risk, long development cycle, or resource requirements too great for private sector funding. One area that comes to mind is the development of technology to recycle and/or dispose of toxic wastes. Other possibilities can be selected from such fields as energy, new materials and health care for the aging.

State and private sector funds would be used for financing cooperative technology projects and technology transfers. Participation should be voluntary. The involvement of state governments would assure the cooperation of state universities. Large companies would find new opportunities for technological cooperation, and new markets for their products and services. Small companies would be able to improve their bargaining position in technology transactions to either establish or expand trading opportunities. For example, small concerns desiring to sell technology for cash rather than exchanging it for other technologies would have the option of selling to the consortium rather than Japan, thereby meeting their own cash-flow needs while enabling the consortium to get equitable technology in return.

"Value-for-value" would be the motto for the consortium. The surest method of achieving equity in the area of technology is simply to exchange it. That is, to import from Japan technology of a value equivalent to that exported.

Having outlined the essence of the regional approach and the reasons for selecting Japan as one of the initial partners, let me now review the two main reasons for selecting Great Britain as the other initial partner. One is that past studies have shown that Great Britain is second only to the U.S. in the number of technological possibilities that are generated from its research and development effort. In contract to its great creativity in generating technology, however, Great Britain has consistently lacked the ability to exploit it through the complete process of innovation. On the other hand, the U.S. has a much better innovation record. Hence, the stage is set for a highly productive technological cooperation between the U.S. and Britain.

The second reason for choosing Great Britain is the similarity in culture between the two countries. Any broad-based cooperative program will be confronted with many problems, and cultural differences will tend to exacerbate them. Hence, progress is initially likely to be faster with Great Britain, where the differences are relatively minor, and this experience can be used to good effect in solving more difficult problems in a Japanese cooperative effort. However, aside from cultural differences, competition provides advantages to all parties.

The administration of a regional approach to technology and trade would not be easy. However, there is adequate experience to draw on to assure its success. The payoff will be the establishment of a system that will promote open, competitive and equitable conditions for technological cooperation and trade.

CONCLUSION

What the United States needs most of all is a surge of innovation on an unprecedented scale to improve productivity and create the new jobs so badly needed. The broad sweep of cooperation I have outlined is the centerpiece of such a program. It is do-able and affordable. It's do-able because all parts, with the exception of the regional approach, are being successfully implemented today, albeit on too small a scale. Furthermore, there aren't any technical frontiers to break with the regional approach—success depends primarily on dedication, and I believe there is a desire to do it.

And the program is affordable because its main thrust is to increase the efficiency with which we utilize present resources. Therefore, the stage is set and I can't think of any reason for not proceeding full speed ahead.