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U.S. Technology Leadership in the International Marketplace

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Technological competitiveness is fundamental to any major goal to which this nation aspires -- an increased standard of living, more and better jobs, and our national security depend on competitiveness. The issue of our competitiveness has a contradictory character. On the one hand, the economy has responded beyond our expectations.

It is the strongest recovery in 30 years. The Economic Recovery Tax Act provided U.S. businesses with investment tax credits, accelerated cost recovery and a significant reduction in long-term capital gains taxes. This was landmark legislation and its profound effects now are becoming visable.

- Investment in plant and equipment has grown 15 percent annually since 1982 and stimulated investments in automation and advanced technology.

- It has stimulated an explosion of small business formation. In 1984, over 650,000 new companies were formed, against 40,000 that failed. Nine million entrepreneurs now run their own companies. Over 450 venture capital funds now manage $16 billion in assets.
- Basic industries such as automobiles are once again profitable.
- We are experiencing the highest real GNP growth without inflation since the 1950's.
- One reason for the strong dollar is the recovery.and the attractiveness of the investment climate here relative to other nations.

All this is occurring at a time when smokestack America has been writing off and shutting down the largest collection of obsolescent facilities the world has ever known.

This economic miracle, as Europeans have called it, began about ten years ago and has created over 21 million new jobs while absorbing a baby boom and millions of women and minorities into the workforce. The economic recovery accelerated this process with over 7 million of the 21 million new jobs created in the past two years -- an average of over 300,000 a month. Over 90 percent of these have been formed by small companies -- the Fortune 1000 and the European economy have had a net decline in employment over the same period.

But the issue is now sustaining this recovery for the long term in a drastically changed world trading environment. This is the other side of the coin.

Exports and imports together now account for twice as much of our GNP as they did two decades ago.

Over 70 percent of the goods manufactured in this country now face competition from products made abroad. The center of manufacturing has shifted from North America to Japan and other Pacific Rim nations.

Success in the new global economy demands the ability to develop, translate, and apply technology to new products and processes for both the commercial marketplace and our national defense system.

The U.S. emerged from World War II with a commanding lead in science and technology that translated into world preeminance in most areas of business. But this preeminance has eroded in such industries as steel, autos, consumer electronics and machine tools.

One indication of this erosion is the $123.3 billion trade deficit recorded in 1984. Our trade in manufactured goods went from a $12.5 million surplus to a deficit of $90 billion in 1984. Further indicators of concern is the lower rate of productivity growth relative to our foreign competitors, the decline in real rates of return on

manufacturing assets below the rate of return on bonds, the decline in world market share in many of our high technology sectors, and stagnating growth in real hourly wages. The foreign challenge to our high technology sector is particularly troubling since these industries represent a major source of our export growth and are vital to improving the productivity and performance of many of our traditional manufacturing industries and the service sector.

This erosion is occurring even though the U.S. still funds about half of the free world's R&D and is still at the forefront of scientific research in almost every area of commercial interest. In 1984, some $10 billion in basic research was funded which represents a pool of fundamental knowledge that is still several times that being developed by any other nation.

So What's the Problem?

We have not been as adept in translating this fundamental pool of knowledge as effectively as we could into new products and processes. Other nations have licensed or acquired U.S. early stage technology as a matter of policy and have found the necessary investment for its further development and are employing a vast array of market distorting techniques including subsidies, limiting market access, and targeting strategies to capture worldwide market shares.

Our ability to compete technologically is also of vital concern to the defense community. Our military systems have become pervasively more high tech and leading edge technology is now more often developed in the civilian sector rather than the military sector. Since exports are increasingly technologically intensive and more technology is dual use in nature, we have an ever confounding problem, one that will get even more intractable in the future, that is controlling more and more civilian technology with military applications while at the same time permitting industries to exploit the competitive advantages of advanced technology in a global market.

While export controls do play an important direct role in supporting U.S. foreign and defense policy, there is the potential for creating an adverse indirect effect of such controls on the competitiveness of American industry, particularly when such controls are applied unilaterally and the target nation merely purchases comparable products or technological know-how elsewhere from US. competitors.

This point takes on added meaning when we realize that the value of knowledge is now doubling every 10-15 years and the majority of new scientists/engineers will be working outside the United States.

Therefore, in the years ahead, the development and application of new technologies will be a highly international process. Industrial firms both large and small are creating a vast and complex network of international collaboration. These include:

- cooperative R&D
- technology exchange agreements
- foreign acquisition
- joint ventures for production and marketing.

There are many reasons for this collaboration -- pooling of resources, sharing of costs and risks, but it appears the major reason is to gain access to foreign markets and stay abreast of technology development around the world -- markets and state of the art technologies which might be closed off.

Therefore, we should recognize that the U.S. has been fueling both foreign and strategic defense competition, with a resulting slippage in our position. The rest of the world is rapidly expanding its technical capacity. If technological competitiveness is to be maintained, it is essential now that attention be sharply focused on the innovation process which develops new products and processes.

Government Role

This brings me to the question of an appropriate role for the government. Let me begin and say what government should not do. It is not the role of government to legislate competitive performance -- or to give government an active role in the development of specific industrial sectors or strategies. Rather, the proper role of the government is to improve the environment for competition. Congress must avoid the temptations of legislating direct involvement in the competitive process through industrial policies or protectionism as a means of gaining competitive advantage. Bureaucrats in Washington, D.C. should not be choosing between winners/losers - this is tough enough for managers and investors. Besides, if we gave government increased power to allocate resources among industrial sectors, politics would play a major role and the history of Federal intervention is that special help is given to those industries and regions well represented "inside the beltway" to the detriment of emerging industries and interests.

Indeed, when we look at the issue of competitiveness policy, there have been at least 17 major reports issued on the subject in the past 30 months which involved leaders from virtually all business sectors (high-tech, low-tech, big, small, unions, academia, public policy institutes, along with many citizens.

- Labor - Industry Coalition on International Trade
- Business-Higher Education Forum - America's Competitive Challenge
- Ameritrust - Choosing a Future
- Business Roundtable
- National Commission on Excellence in Education
- AFL-CIO - Reindustrialization and the Two-Tier Society
- President's Task Force on the International Private Enterprise
- National Aeronautical R&D Goals

These are a few examples and all agree that the fundamental responsibility for competitiveness rests with the private sector.

The extent of consensus is remarkable in what the nature of the problem is and what the solutions are. Even industrial policy advocates are no longer enthusiastic for a large central bureaucracy of banks and tripartite councils. This does suggest to me that in our own way, the U.S. does have a consensus-forming process. In fact, the President's Commission on Industrial Competitiveness established by President Reagan in June 1983, consisted of 30 members drawn from business, labor, academia and government.

All right. Let's take a look at how the Commission proposes to improve our competitive advantage.

This chart sums up the Commission's view of where we stand now and where it sees the potential improvement by action in both the public and private sector.

Technology is our greatest advantage. You'll note the distinction made between technology that is incorporated into products and the process technology used to manufacture them. This country has neglected the development of a competitive advantage in manufacturing, and that is an area in which our Japanese and newly industrializing country competitors excel.

To move on to the question of capital, we heard testimony from a wide spectrum of economists who actually agreed that the cost of capital to U.S. industry is significantly higher than for their competitors abroad. You'll note that we suffer a disadvantage with respect to the exchange rate, however we may have to compete under this disadvantage as long as the U.S. remains an attractive investment climate. Here reducing the Federal deficit, restructuring our tax system and pursuing more stable monetary policy can be of great assistance.

In the area of human resources, you'll note that the Commission decided that the competitive disadvantage of high costs is one this nation will want to keep. Maintaining our standard of living is the goal of competitiveness.

But we have a great deal to do in learning to work together more cooperatively, in forging a common purpose within our business organizations, and in providing training and retraining opportunities, utilizing education technologies, and in strengthening the ability of our universities to train engineers and business leaders.

In the international trade environment, we need to do two basic things. The first is to "get our own house in order," as they say. We need to make trade a national priority and enunciate and implement trade policy with a strong single voice.

Second, as we looked at the world trading environment, the Commission was struck by the fact that while the total volume of world trade is growing dramatically, the proportion of that trade covered by rule of international agreement has diminished.

Over all, the Commission made some 32 recommendations and they are undergoing review by the CCCT and the President.

The Innovation Process

Now let's apply some of these insights to strengthening the innovation process. Innovation is not an instantaneous event. On average, it takes 7 to 10 years to produce a significant new product or process. Statistically, perhaps 1 of 20 products that starts in the laboratory ever produces an adequate return on investment. It is an uncertain investment.

Innovation can be considered in a simplified model to be a three-phase process. (See chart) Phase 1 is the invention. The government invests $10 billion a year in this process. Phase II involves translating that invention into a product or process that can be commercialized (about 90 percent of the R&D costs, risk, and time. Phase III is successful commercialization, which also can involve considerable uncertainty.

R&D, A Form of Capital Investment

The 1981 Economic Recovery Tax Act (ERTA) has provided substantial incentives for investment in capital assets for commercial manufacturing operations (Phase III).

However, the entire R&D process is a form of capital investment that must be amortized over the life of the product or process it produces. It is also an investment that cannot be fully appropriated by the private sector. Under current law, it does not qualify for incentives applied to conventional investments. In fact, it is the only form of capital investment for which no significant incentives have been available. Given the high cost of capital in the U.S., there is a serious deterrent to investment in R&D programs that have no prior guarantee of success.

As a result, many companies have not made the R&D investments necessary for them to remain competitive with foreign industries, especially when the innovation process has been heavily subsidized by those governments.

Recently, the R&D Limited Partnership (RDLP) concept has been developed to partially offset the cost of capital investments in R&D, and therefore the risk involved. RDLPs provide tax incentives for individuals to invest in R&D. These incentives reduce the cost of investing in R&D sufficiently to fund programs that have reached an early prototype or pilot plant stage -- $2.5 billion in the past 3 years.

Adequate funding is still not available for the higher risk, early-stage developments that are many years away from commercial operation. If the U.S. is to benefit from its investments in basic research and maintain leadership in industrial technology, then it is important that the funding gap be bridged between first technical demonstration in the labaoratory and the prototype stage.

One mechanism that can help close this gap is through the use of new cooperative R&D mechanisms like the MCC, and SRC. In our view, joint R&D have many procompetitive features -- reduces duplication, utilizes scarce technical personnel and achieves economies of scale. These ventures are absolutely

essential if we are to meet the challenge of foreign industrial technology in emerging technology areas. The National Cooperative Research and Development Act of 1984 removes antitrust barriers to such ventures. Already 13 such proposed ventures have notified the Justice Department.

Another way to close this gap is through the development of new patent and intellectual property laws.

Fed. Tech. Management P.V.

- One of the primary ways U.S. business gets a leg up on competitors is through establishing proprietary positions ~~through~~ in patents, trade secrets, copyright and trademarks.

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- $55 billion of U.S.'s $110 billion annual R&D investment is made by the Federal Government.
- One of Commerce's primary initiatives is aimed at establishing policies which enable federally-funded inventing organizations (including Federal laboratories as well as contractors and grantees) to establish whatever proprietary positions in their inventions are necessary to create an incentive to their future commercial development, and eliminating any barriers to their proper management.

The Federal Technology Management Division ~~is under~~ has undertaken the following actions to reach the Department's goal as discussed above:

The Federal Laboratories

Today, there are over 380 government laboratories performing research and development to support Federal programs or needs in such diverse fields as health, space, energy, agriculture, and defense. All of the work done by these labs is highly specialized and some of it is classified for national security.

Because these labaoratories conduct a significant portion of all R&D performed in the country, and employ about one sixth of the nation's scientific personnel, recent studies of the labs have recommended that ways be found to increase the flow of technology from them to the private sector.

Federal laboratories and universities have much in common, including their role of creating new technologies needed by industry. A recent Federal Law (P.L. 96-517), which allows universities to own inventions produced with Federal funds, has led to major changes in the way universities manage research results. They have created special offices to promote and license patented inventions.

More inventions are being reported by researchers. There is closer cooperation with industry. And universities are enjoying substantial new funding, both through patent royalties and industrial support for additional research.

Today disincentives inhibit cooperation between Federal laboratories and industry. Old conflict-of-interest regulations limit financial incentives for inventors and isolate them from firms that need their advice. Managmeent systems cause laboratory directors to view assistance to industry as a diversion of resources from their lab's primary mission. Some labs are required to pay patent application costs, but are not allowed to keep royalty returns. Other labs largely ignore commercial potential when deciding to patent their inventions.

Present practice has made the Government the largest patent owner in the Country.

The university experience shows how the Country could benefit from two relatively simple types of changes with respect to our Fedeal laboratory system.

First, there needs to be a clear assignment of responsibility to evaluate new tecnologies, make patenting decisions on the basis of commercial potential, promote licensing agreements, arrange for inventor support during product development, and arrange for lab/industry cooperation on future research.

Second, stronger incentives for industry, inventors, and laboratories are needed to increase their collaboration.

Industry needs assurance of a continuing right to use a new, Government-invented technology. In some cases, this will mean different licensing provisions than are customary today. In other cases, it will mean rights to own the results of future business-lab collaboration. Major investments to develop, manufacture, and market products require the incentive of licenses or patent ownership.

Inventors need financial rewards based on a share of royalties. In some cases, they also need time to advise firms on how best to use their inventions in new products.

Laboratory management systems should also provide an incentive for cooperating with industry. This can take many forms including favorable performance evaluations of lab directors, citations, and use of royalties for additional research.

This combination of management focus and reinforcing incentives will be the best way to bring about the needed changes without detracting from the ability of the labs to continue to perform their important work.

R&D TaxCredit

Also, legislation has been proposed both to extend and expand the 25 percent R&D incremental tax credit, due to expire at the end of 1985. Under present laws, these credits are not allowed for start-up companies, prototype manufacturing processes or for new cooperative ventures attempting to develop new products or processes.

Export Controls

Finally, with respect to export controls, we must design a system that is effective and multilaterally agreed and applied. At issue is whether we can achieve such a system. Absent such conditions, export controls unilaterally applied may have the effect of increasing uncertainty in the innovation process and preclude the advantages of economies of scale and actually undermine indirectly our technological competitiveness in both the defense community and in the commercial marketplace.

Though Congress and the Executive Branch have yet to conclude their versions of these proposals, they illustrate promising new ways to reduce barriers and increase incentives for industrial innovation.

Conclusion

Enhancing our innovativeness and competitiveness will depend more in the long-run on what actions we take here at home domestically rather than changing the behavior of overseas competitors. Not that some behavior doesn't need changing -- like access to Japanese markets -- but we will gain a long-term advantage by running faster than the other guy.

The appropriate government role is a proactive role that removes barriers and provides noninterventionist incentives for innovation. Moreover, nonadversarial forms of collaboration between government, industry and academia will be critically important if U.S. industries are to regain and maintain technical and industrial leadership in a rapidly evolving and competitive global economy.