A US PERSPECTIVE ON INNOVATION POLICY: WHAT IT WILL TAKE TO REGAIN AMERICA'S TECHNOLOGICAL EDGE

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PREFACE

From its very conception the Management and Technology Area has been interested in Industrial Policy Issues. This interest increased after the Innovation Management Task started its work. Several collaborative papers have been written which address the problem of industrial policy in different countries (for example, Honko 1980, Csikos-Nagy 1980, Haustein 1981) or some industrial branches (for example, Kobayashi 1980, Haustein 1980).

In spite of the fact that this paper by Dr. Myron Tribus was written two years ago, it is an excellent introduction into the US scene where industrial policy discussions are an important issue (see for example, "Capital Formation and Industrial Policy" 1981).

The interesting issue which is raised concerns the longer-term horizon in government and company activities and their implementation. This is particularly relevant to industrial restructuring which challenges most of the industrially developed and developing countries in the years to come. Therefore this paper is very relevant in solving many recent policy issues.

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INTRODUCTION

The election is over. It is time to get to work and rebuild America's technological capabilities. There are many reasons to do this: We need to compete more effectively in world markets, including our own. We need to be able to import the things we need. We have cities to rebuild. We have energy systems to construct. We have transportation systems to repair. We have defenses to shore up. It is time for the government to become a genuine partner with American enterprise in rebuilding our technical capabilities.

Technology gives a competitive edge to those who use and develop it over those who do not.

HOW AMERICA BECAME THE FIRST TECHNOLOGICAL SOCIETY

America's love affair with technology started with the founding fathers. Hamilton, Washington, and Franklin were themselves inventors. They were not afraid to invent either hardware or social systems. They understood the basis for technological advance because they created technologies themselves. Hamilton argued for an industrial nation; one that favored skilled immigrant workers and protected fledgling industries.

The eagerness with which Americans embraced technology was a wonder to the rest of the world and had a profound impact on America's rate of economic growth. For example, in 1794 a skilled worker could clean at most 6 pounds of raw cotton per day. Then Eli Whitney introduced the cotton gin and productivity increased 100 fold. The news of the new invention did not reach England until after the first bales of cotton were deposited on the docks. They were seized as contraband, for who could believe that such a small country

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with so few poeple could produce so much cotton? Some economists have computed that technology is responsible for 88% of our growth in productivity.

There were many opinions why America became the world's first technology based society. In 1822, the American Journal of Science said it was due to the "degree of civil liberty which leaves the mind untrampled to avail itself of its own strength". Freedom is essential to creativity, and America offered freedom.

But freedom alone is not enough. After all, the native American Indian was free, too, until the white man came. Freedom is essential, but by itself, it does not produce anything. Education makes the difference. The founding fathers understood this. In 1734, 42 years before Independence, Benjamin Franklin was publishing tracts on the importance of education, especially education in the useful arts. Thomas Jefferson tried to change the Constitution of the State of Virginia to guarantee education to all. He founded the University of Virginia after retiring from the Presidency. Our forefathers understood how to plan for the future.

Concern for the advancement of agricultural technology led to the establishment of Land Grant Colleges in every state, under the Morrill Act of 1862. From this act there came such great institutions as MIT and the University of California.

But the founders did not stop there. They knew that, while freedom and education were essential, they were still not enough. They knew that technology requires an infrastructure. In 1789 they created the Patent Office. It is difficult for anyone now to appreciate the importance that was attached to the Office of Commissioner of Patents in those early days. The Commissioner, for example, was responsible for rendering to the Nation a report on developments in technology at home and abroad.

Over our history we have created other institutions whose sole function was to advanced technology or to provide technologies for special government service. The National Bureau fo Standards, the Weather Service, the National Advisory Committee for Aeronautics, forerunner of today's space agency. It would have been unthinkable in an earlier era for the Congress to have approved the Mansfield Amendment prohibiting any agency of Government from sponsoring technology not directly concerned with its mission. Some of the great strengths of American technology in the immediate postwar period grew out of the general support for research and education by the Office of Naval Research.

FEDERAL SUPPORT FOR INNOVATION

Today we hear a great deal about decreasing the size of government, and in general this is a trend to be encouraged. However, we should keep in mind that historically the Federal Government has been an important source of support for technological advance.

Digital computers were first developed under support from the Census Bureau. This was the beginning of IBM.

Regional Federal Centers for Agricultural Research and technical assistance to farmers, in addition to the Agricultural Colleges established by the states, provided the basis for the most productive agricultural system the world has ever seen, the "Breadbasket of the World".

When the Xerox Corporation was still the struggling Haloid Company, it received federal assistance in the development of xerography when private sources would not support it.

American aircraft now dominate the world's airways because of financial and technical support from the military and NASA.

Major advances in engineering applied to medicine have been federally funded.

Over 100 million Americans watched the exhostages deplaning in Algiers, saw their families in California rejoicing, and heard commentators in Washington--all at the same time over a satellite system that would not have been in existence were it not for collaboration between the Government and the private sector.

And who now expects us to develop fusion energy without the Federal Government as a partner?

The point is that great advances have been made in the past with the government and industry in a partnership. The results have been spectacular. They have repaid the nation many times over.

But in recent years there has been a change. The American advantage has been whittled away. Other countries, notably Japan and West Germany have beaten us out in our own markets. American wages have historically been higher than elsewhere; the difference in productivity made such wages possible. But today, engineering has been combined with lower wages in other countries to provide superior products at lower prices. Unless our standard of living is to deteriorate further, we must regain the technological edge.

Today we deal with harsh realities:

The automotive industry experiences its worst losses since the great depression. America is now the second largest automobile producer.

The steel industry wants protection because it cannot compete with Japanese steel makers who have better equipment, better educated workers, and higher productivity.

Home television and hi-fi markets are dominated by foreign equipment.

Of the hundreds of thousands of home video tape recorders to be sold in America, none will have been made by an American company.

The list of lost domestic and foreign markets is depressingly long. From plywood to shoes to pocket calculators we are losing jobs and income.

We like to say that the problem is that the Japanese studied and copied us. This is only partially true. Recently a Japanese industrialist said: "You in the United States have in the last ten years doubled the number of people in law schools while you barely even maintained the number of people in engineering schools. We in Japan have not increased the number of lawyers but have doubled the number of engineering students. Lawyers are concerned with dividing the pie; engineers with making it larger".

In the play "Fiddler on the Roof", Tevye is asked how the fiddler manages to stay up there. "Tradition", he replies. The leadership position is always precarious; no place to go but down. We have forsaken our traditions.

TECHNOLOGY FOR THE FUTURE, NOT THE PAST

Sometimes it seems that our policies are developed only to meet the problems of the past. We try to rescue our industries after they are in trouble. We do not try to anticipate. Many people seem to want technology only to regain the good old days when we had our way in the world. But there is no chance to regain the 50's and 60's. The future will demand all we can do just to survive.

Some things are clearly evident about our future. There are three forces already at work:

POPULATION EXPLOSION: No one knows how to turn it off.

RESOURCE DEPLETION: Prices of natural resources will rise sharply unless new technologies are brought to bear.

RISING EXPECTATIONS WORLDWIDE: Everywhere ordinary people are becoming restless.

These three forces have already produced four consequences:

UNSTABLE GOVERNMENTS: We have difficulty determining who will be dependable allies.

UNCERTAIN SUPPLIES: No manufacturer can be certain about raw materials and fuels.

INTERDEPENDENT ECONOMIES: Every nation now depends on other nations to supply things it needs but cannot find within its borders. No one can go it alone.

SHARED ENVIRONMENTAL DECAY: Spaceship Earth has but one atmosphere. We share acid rain, polluted seas, and hazardous chemicals shipped across borders.

While we ponder what our strategies are to be, it is well to keep in mind that there are at least 100 other sovereign nations on this same globe, and they, too, will be pursuing their strategies. We cannot say, of course, just what they will do, but some principles seem to be self evident:

Those who have will try to keep

Those who have not will try to get

Local leaders will try to exploit whatever they can

Competition for scarce resources will intensify

Of all the nations of the world, I believe that America has the best chance to cope with the future. But to do so we need to get our act together. We need to regain our ability to deploy technology in our own interests. Technical competence is absolutely essential if we are to have any options. If we are to avoid clashes with other people over scarce materials, we need substitutes. If we are to pay our way in the world, we need to be able to produce goods and services that other people want and are willing to pay for. If we are not to be blackmailed, we need the options that only technology can afford.

It is likely that the competition for scarce resources will take every form: political, military, ideological, commercial, terroristic, and combinations of these yet to be invented. If we are to keep the worst of these from

affecting our way of life even more adversely, we need the capability to deal with these problems. Without technology we shall have no options.

WHAT WENT WRONG?

There are many reasons offered as to the decline in America's advantage and many fingers are ready to point. But in the words of Pogo, "We have met the enemy and he is us". The lost jobs and lost markets are the symptoms of a deeper, underlying disease. We are losing the race for one basic reason, from which all other difficulties flow.

INDUSTRY AND GOVERNMENT DO NOT DEVELOP STRATEGIES FOR THE FUTURE

For some reason the work "plan" has become a dirty word in American politics. Whenever anyone uses that word, images of the failures of Soviet plans appear before our eyes. No American politician can afford to espouse a "planned economy". The problem is that we do not distinguish between the concept of a "strategy" and a "plan". I believe it is the responsibility of the government to develop, in concert with industry, a "strategic plan" for the future. As large industries have discovered, when an organization gets very large it is no longer possible to run it efficiently from the top. Instead the headquarters must prepare, with the cooperation of operating divisions, a broad strategy concerning what the objectives and guiding principles of the corporation are to be and these in turn are then implemented by plans made at the lower levels, where the problems are. The more successful at adaptation the corporation wishes to be, the more decentralized the decision making has to become.

We need to overcome the fears of planning long enough to discuss the differences between a "strategy" and a "plan". In my opinion a good national strategy will permit us to coordinate our resources for foreign markets while preserving intensive competition at home.

But the failure to develop strategies for the future is not just a matter of misunderstanding the difference between a strategy and a plan. In the political arena there are no real pressures to encourage the President to plan much more than three years ahead--just to the next election. Representatives must start thinking about the next election as soon as the last one is finished.

Chief Executive Officers of major corporations have told me that they are under intense pressure to make the next quarterly report look good. As one news release put it, "Around here long-range planning meant 'What are we going to do after lunch?'"!

These pressures come mostly from our sources of capital. We complain about our youth being the "now generation" because they want everything now and are unwilling to wait. But where did they get the idea, if not from their elders? The demand for high rates of return have stifled long-range planning. Anything that takes more than 20 years to pay back cannot meet the test of America's business managers. The only reason that truly long-range advances have succeeded is that the backers did not understand how long it would take. I have personally seen products that made it to market only because the technical people lied to their bosses about how long it would take.

One of my colleagues puts it this way: The interest factor in the rate of return calculation is really a measure of the disinterest in the future.

The demand for high rates of return is the main reason we have traded tomorrow's technology for today's profits. This worked out as long as we were competing with ourselves and not with other people who put a different value on time. As long as we plan only for the short term and they plan for the long haul, eventually we shall lose out. And history tells us that losers are never treated gracefully.

The problems we face have been a long time in the making. They will not be cured in four years either. We face these problems because 20 years ago we thought that 20 years was a long time. All of us are to blame. The politicians who did not plan beyond the next election, the business leaders who did not plan beyond the next quarterly report, the stock analysts who egged them on, the newspapers who headlined only the immediate and spectacular--and the electorate, that supported it all.

THE COST OF NOT PLANNING AHEAD

We can understand better the cost of not planning by comparing the performance of American and Japanese steel industries over the last 25 years.

In the early 1950's, as a result of some strategic planning on the part of the Japanese Government and the steel industry, a long-range plan was developed by each of the companies. They set about their business methodically, each change not being significant in and of itself, but the combination proved enormously effective.

They relocated their steel mills to make each of them part of a harbor complex for the efficient unloading of ore and the loading of steel for foreign markets.

They set their sights on foreign markets, especially ours, and studied which markets, on a worldwide basis, would give them the best entry point and opportunity to capture the benefits of mass production.

They started educational programs for *all* their employees, making them partners in innovation, preparing them to adopt new technologies.

They started a collaborative program of research and development to replace their production processes with less energy intensive ones, knowing that the cost of fuel was bound to increase.

They worked out collaborative forms of research but they competed fiercely with one another to be the most advanced technologically.

Most of all, they set about making their companies stable employers, sacrificing larger profits for larger shares of the world market.

Meanwhile, according to a report issued by the Office of Technology Assessment, American companies modernized and upgraded their facilities at a much slower pace. For one thing, American money was more expensive to get. In Japan, with the approval and encouragement of the government, Japanese companies borrowed money from banks at favorable interest rates. In America the companies had to go to the stock market where they competed with all other companies to show high rates of return. Fifteen years ago a market analyst would have computed that American companies were more efficiently managed than Japanese companies, because their rate of return was higher. But this was satisfactory to the Japanese because they only had to satisfy the bank's low interest rates and demonstrate that they were stable institutions. In the

United States, to quote from a personal friend who happens to be a stock broker: "American business marches to Wall Street's drum".

I doubt that a telephone call in the middle of the night could set off a wave of selling in the Japanese stock market.

Eventually, the future arrived, and now we see the fable of the grasshopper and the ant played out on a gigantic scale.

We should not try to make the managements of the steel companies our scapegoats. They were running their companies according to the way they were being taught to run them by our best schools of business administration. Any manager who strayed too far from accepted norms would have lost his job. As Caesar said, "The fault lies not in the stars. It lies with us".

According to a report in a recent issue of the Harvard Business Review, "Managing our Way into an Economic Decline", two respected Harvard Business professors claim that the way our managers have been taught for 25 years is wrong. In a delightful little book, "Freedom in a Rocking Boat", Sir Geoffrey Vickers describes the modern corporation as having two spigots. From one spigot there flow the goods and services needed by a society. From the other spigot there flow the tokens with which to purchase goods and services. The behavior of the company depends upon which spigot the management things is the purpose of the company. The graduates of our business schools by and large have been taught to regard businesses a "money pumps" in society. They can cheerfully skip from one company to another, for all money pumps look the same to them.

Even today our business chools teach students that it is always best to be second in the field. New technology is adopted only when it is forced by competition. This is not a bad strategy if everyone uses it. But if the competition has a different idea and if the time lag in being able to adopt and use a new technology is great, the results can be disastrous. It took 12 years for the basic oxygen process to be adopted to the point where it produced 20% of American steel output. The time to reach the same fraction in Japan was five years. Part of the delay is due, of course, to the higher expense of American capital and part to the demand for higher quarterly earnings. But that does not tell the whole story.

A few weeks ago I read an interview with an engineer laid off from Chrysler. He said, "I worked for them for 18 years, trying to build the world's greatest automobiles. I guess I was the last to realize that they did not want to make great cars; they only wanted to make money".

In a radio interview over a Boston station an executive from a motor car company said, "In 1976 one of our financial men asked me, 'Since we make $400 on each large car and only $100 on a small one, why do you make small cars'?" The executive paused and then he said, "I guess we shouldn't have listened to him".

MANAGEMENT, THE KEY INGREDIENT

Harry Truman kept a small sign on his desk, "The Buck Stops Here". In any organization, responsibility stops with the management. The record shows that, by and large, American management has failed in its responsibilities. Fortunately, there are very large variations in the quality of American

management, and we have our share of thoughtful, dynamic, aggressive leaders. In the unforgettable words of Henry Morgan, "The average manager isn't quite up to average!".

For example, if all the steel companies had records of productivity to match the best ones, there would be no fear of the Japanese competition. But our average leaves a great deal to be desired and in many industries we have been essentially wiped out due to the inadequacy of our managements.

For example, an American manufacturer of television sets found itself unable to continue with a particular model. It sold the manufacturing facility and the design to a Japanese company. Under the American management the number of defects per set at assembly was such that they had to assemble 1.4 sets for each completed one. The Japanese management shut down the plant for a year, redesigned the assembly and procurement procedures, and then opened the plant with American labor. The defect rate dropped to one or two per hundred. The company now prospers, selling essentially the same basic design. The difference was the management. The Japanese managers say that the American workers are as good, or better, than their counterparts in Japan. The workers like the Japanese methods. There have been many comments on this case but the one I think sums it up best is this: "The difference is that the Japanese managers put people ahead of numbers".

THE APPROACH OF THE REAGAN ADMINISTRATION

We who complain about the government and pillory our politicians for not solving our problems often do not realize how much we ourselves are part of the problem. We should be grateful that there are people willing to accept these jobs. Just about anyone who takes a high post in Government today makes a personal sacrifice to do so. Therefore, what I say tonight should not be taken as an attack on anyone.

The Presidency was won by a promise to the American people to reduce the size and influence of the government, especially the tax burden. The broad outlines of the Administration's strategy are contined in a document now known as the "Stockman Manifesto". That manifesto has as its main objectives repealing regulations, lowering taxes, and in general getting government out of the way so that market forces can drive the economic system. It is hard to quarrel with what is proposed by Mr. Stockman, and I do not propose to do so. The President has a mandate to try this philosophy of government. He should be given a fair chance.

What troubles me about the approach that this Administration appears to be taking is that, while in the long term market forces may work, there are imperfections in the market which often delay the response. It would be a pity if the Administration's philosophy were never tried because the market forces upon which the whole strategy depends were not actually working. There will be an election in 3 years and 10 months and if the system does not show understandable results by then, the entire philosophy may be abandoned. Who knows what the people will turn to then? It seems to be critical, therefore, to the entire position of the Administration to examine the Stockman Manifesto and to try to improve its chances of success.

The Stockman Manifesto depends for its success upon American management stepping up to its challenges. But not everyone is sanguine about that. Dave Kearns, President of Xerox, has said that the trouble with American management

is that it no longer takes risks, but hides behind complaints about Federal regulations, environmental laws, etc., etc. He reminds us that the Japanese meet the same regulations in our market place that our manufacturers do. They have equally stringent environmental protection laws. We cannot afford to rely upon a strategy which is based upon the idea that given complete freedom, American management will do the right things for America.

In a thought-provoking little book, Dynamic Economics, Burton Klein argues that it is not the hidden hand of Adam Smith that makes industry innovative. It is rather the "hidden foot" of competition. Therefore, I believe that, in addition to making the market forces felt, the government needs to make domestic competition much more intense.

Is there anyone who believes that, relieved of the Japanese competition, American managements would work to produce better cars? Or would they try to make their companies more profitable? In my opinion, the major weakness in the Stockman Manifesto is its reliance upon the capabilities of American management. Perhaps in due time market forces will bring forward better managements. But when great companies like Chrysler go under, the suffering in human terms is enormous. Some complex systems are like Humpty Dumpty; they cannot be put back together again once they have had a great fall. Those who suffer most are not those who ten years earlier decided to put Chrysler on suicide course. They are not the ones laid off. Simple justice, if not concern for our overall economic welfare, dictate that we do something about it. Sometimes you have to forget your principles and do the right thing!

TO BAIL OR NOT TO BAIL, THAT IS THE QUESTION

No one thinks it is good policy to bail out companies that fail. The managements and unions that together cannot agree to remain competitive, who do not know how to moderate their demands for profit, who do not think of the future, do not deserve to be supported by the rest of us. That is a good rule to follow, but it isn't always applicable. Sometimes a whole industry gets into trouble. The company that is in deep trouble is often not alone. Something like this seems to have happened to the American automotive industry.

I believe that when a company like Chrylser begins to emit death noises, and when the rest of the industry is obviously in difficulty, the Federal Government has a responsibility to act. But what it does with our money is too important to be left to the whims of the political scene. We need to have a strategy for dealing with such industries. Unfortunately, we have probably not seen the end of them.

I most emphatically do not believe that we need a super agency to look over sick industries. We do need to understand the industry in its entirety. The sickest of the companies, such as Chrysler was, should be given the opportunity to develop a "get well" plan. That plan should be a public document, discussed at all levels of the company, with the union, with the workers, with the engineers, with the sales force, with the distributors, with the suppliers, with the creditors ... in short, with everyone who needs to contribute to the success of the company. In my opinion it is a mistake to confine discussions to the managements of sick companies. If they are the size of Chrysler, the odds are that no one, especially the management, really knows what is going on. It will be essential to build a new team. It will be essential for everyone to do so in a hurry. That is the prerequisite to genuine change, and this understanding must permeate the entire organization.

I further propose that when the company has put together its "get well" plan it should be examined by a blue ribbon panel of experts in the industry. We know from the experiences with the Kemeny Commission that America does have good people who will give of their time in competent service to the country. If the special commission accepts the plan of the company, it should be supported and protected according to the plan without further federal interference. The cure may mean limited protection from imports. It may mean favorable loan terms. It may mean relief from some regulations. But it also should mean a company developed long-range strategy to become the best and most competitive company in the world. It should not provide a shelter to make the company profitable in the short range. Above all, it should not be a means to return to being only a money pump.

AN AGENDA OF THINGS TO DO THAT DO NOT COST A LOT OF MONEY

One of the saddest lessons I learned in Washington is that if a proposal does not cost a lot of money, it is apt to be dismissed as trivial and irrelevant. The directive to set back thermostats was never enforced by anyone, but when fuel costs rose, it was recognized as in everyone's best interests. The directive has been followed by enough citizens to produce measurable savings in oil imports.

Approximately 60 years ago Herbert Hoover, then Secretary of Commerce started the voluntary standards system which has had such a healthy influence in producing the mass markets that made volume production possible. The cost of that effort has been negligible. I believe the government can provide important leadership while we, the citizens, make the changes. I repeat: Mature adults need to understand their own situation, and sometimes the government can help.

We need to begin by looking hard at what we are doing to ourselves by our approach to financing and evaluating our industries. We need to adopt new standards for measuring and reporting corporate profitability. A year ago one of our largest corporations, the General Electric Company, issued its annual report in two parts. One part was according to the conventional methods and the other was in a form the Company thought was a more honest way of depicting its situation.

We know that the way Wall Street relates to business is pressuring businesses to eat their seed corn. The result is to ruin the opportunities for investment.

To do something about this does not require a new regulation or an increase in the bureaucracy. But the government could take the lead in calling conferences of business and finance leaders to examine the way the system works. This is a job that could be done by the Department of Commerce or the SEC. What is required is a cooperative endeavor with the private sector to find a way out of the trap we have built for ourselves.

I have spoken about the education of Japanese workers to get them ready for the future. Our government, working together with labor and industry, can develop strategies for increasing the educational level of the workforce. I realize that managements do not want new issues to haggle over, but I would very much like to see the issue of continuing education become an issue in labor-management bargaining. We need to make up for the neglect of mathematics instruction in our schools. The computer revolution, essential to increase our

productivity will be constrained by a workforce unable to deal with simple mathematics. Our workforce needs to get ready for improved productivity. It cannot be forced from above. It requires worker cooperation.

A SPECIFIC EXAMPLE

Up to now I have been talking in very general terms. I want to give an example of a problem, here and now, that demands attention. It is well known that microprocessors are finding their way into automobiles. The market is estimated to grow to about $10 billion annually. The demands for reliability are about as stringent as for space missions. Both GM and Ford have found it necessary to go to Japan to get the quality they require. The question is: "Is this business to go the way of steel?"

To deal with this issue requires, first of all, that the government develop a strategy. That stragey should be developed with the full participation of industry. The bits and pieces of the competencies that are required are spread over the government, but not coordinated in any way. I believe we need to designate an agency of government to do the following things:

Monitor US and foreign technical progress

Examine the programs of the NSF, DOD, etc.

Examine resource constraints:

- Engineers
- Scientists
- Instrumentation
- Worker education
- Capital availability

Discuss plans and programs of private companies

See that important decision makers in industry and the financial community are aware of what is happening

I am *not* calling for the creation of a large super planning agency along Soviet lines. What I am urging is that the government get its act together. It may well be the result of the study will reveal the best is for the government to *stop* doing something.

ITS FOR REAL

Harrison Salisbury once told this story: There was a prize fight in Madison Square Garden with a badly matched preliminary fight just before the main event. One of the fighters took a terrible beating. He went down and did not get up. Someone in the audience shouted "Fake!" and the crowd took up the chant. They continued to shout while stretcher bearers carried the boxer from the ring. The next day the boxer died. Salisbury concluded: "You know, that boxer *had* to die to prove that the fight was on the level. Sometimes I think that this great nation will have to die before people understand that this fight, too, is on the level."