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A study of the rise and fall of civilizations will reveal that those societies at the forefront of domesticating agriculture and metallurgy, and who developed new technology, had a comparative advantage over their competitors. That study will also show that societies who failed to utilize their technological assets and tools over time lost their advantage in terms of economic, political and military power. As we move into the twenty-first century, we are on the threshold of profound political and economic changes occurring throughout the globe where a nation's technology capabilities and resources are going to play a pivotal role in wealth creation, high quality jobs, quality of life, and security in the broadest sense.

New technology is reshaping every product, service and job. It is providing us with capabilities that we could have only imagined at one time. We have witnessed traditional modes of production, pioneered at the turn of the century by Henry Ford and Alfred Sloan, the so-called Taylorist model of production, become obsolete. In parallel, we have begun to recognize that the management and work organization systems that parallel these obsolete production systems have to be completely changed as well.

The merger of civilian and military technologies, the debate about so called "dual use" technologies, is no longer a meaningful debate. We all accept that emerging technologies have multiple applications that cut across industrial sectors and that require simultaneous or concurrent engineering for product realization in today's global market.

Clearly, the nations of the world that most effectively use technology, and I emphasize use rather than just develop, will be the nations that create new wealth, new jobs, growing economies and improve the overall standard of life for their citizens.

A look at the United States will reveal that we are very blessed in terms of our scientific and technological resources. We have the world's most productive scientific and technological enterprise. We have a tremendous network of world class research universities, over 750 national laboratories, and, of course, industrial facilities and manufacturing operations all over the globe. It would be impossible for any country to

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The following text was compiled from the transcript of the remarks made by Ms. Wince-Smith at the Conference.

replicate the scientific and technical infrastructure that exists in the United States today.

In terms of our national expenditures, we spend, overall, more on research and development than Japan, Germany, the United Kingdom and France combined. That is some seventy billion dollars-plus from the government side, which is matched by similar expenditures in the private sector. Granted, on the government side, a little over half of those resources usually have been expended in the military domain of weapons development and procurement. We are seeing that balance shift with the new priorities of the Clinton Administration to have more government resources directed to civilian versus military activities.

Over the last three decades, we learned to our peril that the United States, at the very pinnacle of its technological dominance and preeminence, began to lose domestic and global market share in many of the high technology industries in which we had pioneered and led the world. Some of the well known examples are in consumer electronics, business and machine tools, and industrial lasers. The semiconductor area was very threatened in the mid 1980s, but due to a number of coordinated government actions and private sector initiatives, has rebounded. An area that I would like to spend a moment on, because it is a real paradigm or a "Catch 22", of structural problems in the U.S., concerns the flat panel display industry.

In the United States we have performed all the underlying, fundamental research for what are now three to four multiple technology paths for flat panel displays. Displays are going to be at the heart of every information application that has a display requirement. This includes end-use computers, telecommunication systems of all kinds, the cockpits of aircraft, medical imaging equipment, and entertainment systems, etc. However, in the United States today, we do not have a significant manufacturing capability to produce displays for their multiple end uses. Our domestic producers are serving specialized defense applications and, in many cases, constitute small, fragile entrepreneurial firms. For the most part, our big end users of displays obtain their supplies or components from their direct systems competitors in Japan. This fact was highlighted during Desert Storm. Pursuant to the Defense Surge Production Act, the U.S. Government had to go to foreign embassies, in this case the Japanese Embassy, and ask them to go back to their industry to certify whether or not Japanese industrial producers would provide the U.S. military with display needs for twenty-year-old weapon systems. Experts estimate that displays are a multi-billion dollar market that is going to determine ultimately the entire integration of the food chain for information systems. For example, some experts have noted that as today's technology develops, the microprocessors for electronic systems are now being embedded in the glass displays themselves. If you cannot produce the glass in a high-

volume, cost-competitive way and have that market, you are going to ultimately see your underlying electronics base threatened as well.

We had a meeting on this issue a few years ago in the Commerce Department where one of our small producers put up a quote from the chairman of Toshiba which said that Toshiba is determined to be the world's leader in flat panel displays. Toshiba was not concerned how much it would cost, or how long it would take, or whether they would make a profit in twenty years. That is the type of competition that is very difficult for U.S. firms to match given the economic system in which our firms must operate.

Our challenge, without question, is to take technology, from whatever source, and translate it into world-class goods and services and capture the wealth it produces in order to have the resources needed to tackle our national needs. In this country we are not going to be able to address health care reform, education, the drug problem, the environment, or national infrastructure if we do not produce wealth. As we learned in the former Soviet Union, it is not enough to just produce jobs.

In short, we have to forge a "commercialization machine" that propels a seamless, integrated system that moves technology swiftly from the laboratory to the marketplace, cycle after cycle. This process has to extend beyond the walls of the private corporation to encompass a very complex mix of interrelated factors on which industry's ability to commercialize technology and capture the markets it embodies ultimately depends. Such factors really have nothing to do with technology per se, and that from a policy perspective as controlled by non-technologists. Many technology policy experts believe that if government just spends more money on civilian R&D, that somehow the U.S. is going to become more competitive in world markets. Moreover, these same policy experts do not understand or make any effort to engage those other sets of issues or factors that are far more important to the *commercial realization* of U.S. R&D assets.

What are these issues? The first concerns the economic, tax, and regulatory environment in which a U.S. firm has to operate at home and, of course, abroad. That would include such areas as the government's procurement process, anti-trust policies, the tax code, its incentives and disincentives, the structure and organization of our banking system, and the management of intellectual property rights ("IPR"), including domestic and global IPR laws and practices.

Let me mention IPR in the context of Japan. Increasingly, we are seeing a number of serious intellectual property disputes between U.S. and Japanese companies with serious big time economic stakes. Part of the problem is that their patent system is very different from ours and has developed over time as another tool to provide protection and advantages to Japanese companies. In Japan, a first to file patent system

exists versus a first to invent, with applications immediately published upon filing. A sequential intervention system can then begin and hold up the final issuance of a foreign patent until the term of its coverage is meaningless. The GAO will issue this summer a report based on a study of how Japanese IPR practices have hurt U.S. companies. One particular case concerned the Government of Japan's refusal between 1955 and 1987 to implement a patent secrecy agreement with the U.S. Government. As a result, many of our patent filings for dual use technologies that had secrecy orders placed on them for security reasons never obtained patent coverage in Japan. Indeed, it was not until the Japanese were interested in participating in the Strategic Defense Initiative (SDI) program that the U.S. Government finally concluded a patent secrecy agreement with the Government of Japan in 1988. Intellectual property rights regimes have a very significant impact on the technology innovation process and most importantly, the realization of wealth from new products. The GATT negotiations under the Uruguay Round of Trade Talks on IPR are very important to the U.S.

Another issue concerns the way industries are structured and collaborate among themselves domestically and internationally. We have heard quite a bit, during this conference, about the business, management and manufacturing practices employed by private firms that impact quality, labor-management relationships, trade, export control policies, and other arenas. Much academic research has documented how the Japanese and other nations have protected their home markets until their domestic industries have reached a certain state of development and are "ready to compete" and how this home market protection has impacted U.S. firms adversely.

Let me now turn to the topic of the roles of government and industry in technology innovation. Government and industry have very important responsibilities to play that are complimentary in fostering a system that will allow the private sector to maximize its deployment of technology and create wealth. There is no question that government has to foster a long-term "risk oriented" not "risk adverse" environment for investment in which the private sector can translate technology into competitive goods and services.

Earlier this year, a very interesting report was put out by Ernst & Young entitled the "Industrial Policy and American Competitiveness Survey," based on a survey undertaken in December 1992. Interestingly enough, the majority of U.S. corporate respondents indicated that the most important needs for them were not government subsidies and increased expenditures for R&D, but dealing with the tax, regulatory and environmental policies that enable them to invest in new product development and successfully compete in world markets with short product cycles.

I will elaborate on a couple of those factors. Clearly, tax and eco-

nomic policies affect the cost and availability of capital. Businesses need to justify long term R&D, product development, and production. We heard from a previous speaker that there is no capital gains tax in Japan. We still cannot reach a consensus in the U.S. that capital gains taxes are not a rich versus poor issue. The Bush Administration had proposed to make the research and experimentation tax credit permanent. Every year Congress would renew the credit, but never make it permanent. The Clinton Administration has also made that proposal a key part of the economic program they just announced.[1]

One adverse economic problem that has just emerged in the Clinton plan is the newly-proposed tax on royalty income. There is real concern from high-tech business leaders about the adverse impact of this tax. Interestingly, it appears that this tax proposal came from the Treasury Department with little analysis of its implications for other major components of the President's agenda, i.e., supporting R&D investment and U.S. high-tech industry. This tax would require a new treatment for merging royalty and dividend income. This treatment, without going into the details, would have two impacts. One, it would encourage U.S. firms to do their R&D overseas. And secondly, it would cost major companies, under intense financial pressures, millions of dollars in additional taxes. This is a case in which one of our strong assets, intellectual property portfolios, would be taxed to the point they become a liability.

One area in which the Bush Administration was very farsighted but, unfortunately, did a poor job of packaging is the matter of banking reform. The debate on banking reform has practically disappeared although most studies on capital formation and short-term investment horizons recommend significant changes in our Depression era banking system and the ownership ties between providers and users of capital. In the U.S. we operate in an old fashioned, obsolete banking structure. In travelling across the country last year through our National Technology Initiative that brought together technologists, financial providers, and manufacturers, we never once heard that banks were playing any significant role in providing risk capital for entrepreneurial and other technology activity in the United States. Now, of course, if one looks at the banking systems of Japan and Germany, where financial entities have an ownership stake in industrial enterprises, behavior and outcomes are quite different. A personal anecdote will illustrate this point. My husband is on the board of a German electronics company. Recently, he came back from a Board Meeting and said that the firm was planning a major investment in an enabling technology. There was a lot of debate at the board as to whether or not to proceed in light of

[1] This summer, the Congress yet again renewed the R&D tax credit, but did not make it permanent.

the risks and long-term return on this investment. He was amazed that the most active and insistent member of the board, who supported making the investment and taking the risk, was a member of the Deutsche Bank. It turns out the Deutsche Bank has an equity ownership stake in this company. I cannot imagine an example of that type of behavior and outcome occurring in the United States. It is not because our CEOs and industrialists have a hereditary gene that replicates itself every generation and causes them to be short-term oriented. Rather, we have created a structural financial system that has divorced the providers and users of capital and removed the bond and incentives of shared ownership.

Banking reform to amend the 1933 Glass Steagell Act and allow a minimum, but critical ownership linkage between the financial community and the industrial community is, in my view, absolutely essential if we are to make the long term investments required for a success in the next century. Yet unfortunately, the issue of banking reform has disappeared from the economic agenda in the new administration.

Government regulation is another critical area impacting competitiveness. It is a boring topic, and there is not much the President can do to get any positive publicity out of streamlining or reducing the regulatory burden placed on U.S. industry. However, there is no question that government regulation is a key determinant of the time, effort and money it takes to get a product to market. Dexter Baker, the current head of the Board of Governors of the National Association of Manufacturers and the outgoing CEO of Air Products, has said that U.S. corporations spend one and a half times more money and effort responding to the government regulatory environment, than they do on R&D. That gives you an idea of the staggering amount of economic resources that we are expending on matters that are not directly supporting national productivity, investment, wealth, and job creation.

We also heard during this conference a discussion about our educational system and the skills and labor force that we are going to need to compete globally in the future. That is one area in which I believe the new administration is going to play a very positive and important role. Secretary Reich of the Labor Department understands the challenge of creating a twenty-first century work force and putting in place the new training systems and labor incentives to reach that goal. It is going to be very interesting to watch to what extent organized labor is going to become a full partner with industrial management to effect these charges essential to the work place of the next century.

Before concluding, allow me to cover one area that is controversial, and that I hope will engender some debate. We have a whole set of new enabling technologies. Some call such technologies critical or emerging. They are really the wealth generators of the next century. They cut across industrial sectors and have multiple applications. Their develop-

ment is interdisciplinary, and they are really going to profoundly change our lives, and how we go about our business. And, to simplify their complexity, they fall into five broad categories: information, manufacturing, materials, the life sciences, and the environment.

I did not want to challenge my former colleague in the Bush Administration, Linn Williams, on the subject of High Definition Television. However, to set the record straight, at the end of the Reagan Administration, there was never any effort underway for the U.S. government to subsidize a R&D program to support *analog* HDTV development or downstream productions. Those involved on the technology side knew that what was at issue was the merger of computers and telecommunications into integrated information systems that would be totally *digitally based.* HDTV, in essence, represented the merger of a broad group of digitally driven compression and display technologies and, at most, HDTV itself could be an initial test bed in which U.S. industry could become partners to develop and test those technologies. In short, HDTV did not represent the desire of technologists for the U.S. government to subsidize the industrial development of an analog "big screen" TV for yuppies.

Unfortunately, the HDTV debate was handled very poorly in the early days of the Bush Administration and in many ways set back the Administration's efforts to promote technology commercialization in the private sector. The people who claimed that this debate was about a government subsidy never took the time and effort to understand the underlying technology issues involved and why they were important. The Clinton Administration's Information Infrastructure Initiative is really the successor to the initial work done in 1987 and 1988 on HDTV and the Reagan/Bush Administration's work on High Performance computing. I know that Former Secretary of Commerce, Robert Mossbacher understood this issue very well and the importance of the integration of digital information technologies and their profound future impact on U.S. industry.

It is not very clear that U.S. industry is going to be able to commercialize these enabling technologies using our traditional investment approaches and, more importantly, our traditional industrial structure and linear process of innovation. These technologies are too complex. One can only return one's investment if the current technology is used in several applications simultaneously and in applications that cut across industrial sectors where industrial entities in the U.S. normally do not collaborate. So, again, how U.S. industry is structured and how it collaborates internally is very important. If one looks at our foreign competitors industrial organization and how it impacts enabling technology development, one sees that U.S. firms are going up against diversified, vertically-integrated, industrial financial giants. Such structures are integrating the producers and users of technology and

accomplishing the entire innovation cycle from research, design, manufacturing and marketing in a closed proprietary structure. I emphasize "closed" and "proprietary". These organizations can quickly pool their resources and share their risks across a wide and diverse product base. This enables them to capture broad-based returns on the economics of scale and scope of these technologies. It also allows them to be nimble or flexible through inter-industry and inter-firm cooperative relationships that allow the introduction of new materials and components simultaneously in many different applications and new markets. The result is that the downstream product lines produce a stable internal market for the new core emerging technology, and this system replicates itself over time.

In the United States we do not have a tradition of close producer/supplier relationships. Indeed, it is legally prohibited in many instances. We joked in the Commerce Department that if we took the criteria of the Malcolm Baldridge Quality Award, which rewards close producer/supplier long term relationships, and asked one of our major defense contractors to follow this criteria in the acquisition procurement activities for the Department of Defense, they might end up in jail. In fact, the U.S. Government Procurement System has created a hostile environment in the defense contracting world where every year a contractor must go out and rebid its supplier contracts. Fragmented, unstable, and destructive relationships are the result. Yet, we know in terms of innovation, manufacturing and quality control, that one needs to nurture long-term producer/supplier relationships.

In my view, a major challenge for U.S. industry is whether or not they will be able to cut across sectors and integrate producers and suppliers of these evolving technologies into cooperative teams. This challenge has a major impact also on defense conversion in the U.S.

One of the programs that we were espousing in the Department of Commerce and that has been supported by the new administration, will promote industry-led, vertically-integrated consortia for enabling technologies. Horizontal consortia bring together competitors, but they are only the first step of the game. In a horizontal consortia, everybody does some generic research raising the ceiling of knowledge for all participants, but not achieving the proprietary first market entry that is needed for market success. In concurrent engineering, where R&D, design, manufacturing and marketing must be linked together, it is highly unlikely that fierce competitors are going to turn over their proprietary "crown jewels", as it were, to their direct competitors in a horizontal consortium.

A vertically-integrated consortium that would link producers and users around an enabling technology with multiple applications could perform the entire innovation cycle from R&D through marketing. Such a structure would accelerate, first to market requirements in a

proprietary industrial environment where one's domestic and foreign competitors are not going to get easy or timely access to your technology. For example, partners in a vertically-integrated team to develop and utilize composite materials, might include an aerospace producer, a sporting goods manufacturer, an auto manufacturer; an appliance maker, a direct material supplier and maybe even a computer systems integrator, because they all need materials for their specific product applications, but are not direct competitors. Such a team could share costs, risks, and pull their proprietary input up front, and move forward with multiple market driven applications. We believe there are no anti-trust problems in such a structure, and that the ideal scenario would involve the formation of a number of competing teams, set up around enabling or critical technologies. Interestingly enough, soon after we issued our Federal Register Notice for the Strategic Partnership Initiative, we had numerous inquiries from Japan. The Japanese understood immediately that this was a significant technology organizational and deployment initiative that would be accomplished if the industries would identify and draw together the stakeholders they needed to team with for success.

We have learned in the U.S. that we can have the best technology asset in the world, and even have the investment financing in place but if we cannot manufacture the product cost effectively, and deliver high quality, the other two resources become meaningless for market success. By the way, in reference to a comment made at this conference earlier, I am not yet aware that the Japanese have given up their ambitions to be a global manufacturer in the twenty-first century. To the contrary, the U.S. and Canada are working very closely on a project called Intelligent Manufacturing Systems ("IMS") that the Ministry of International Trade and Industry ("MITI") developed almost three years ago. Initially, Japanese officials directly approached U.S. universities and companies and solicited their participation in an R&D program on computer integrated manufacturing, software and standards development. The Governments of Canada and Europe realized that many of their universities, who were keen to obtain research money, had given the Japanese the entire road map of their significant research work through this proposal solicitation process. Over the last two years, the U.S., Canada, and Europe forged an international feasibility study IMS that involves the U.S., Canada, Australia, the European Community and the EFTA countries. Our goal is to determine how and under what conditions and structure might work internationally in the development and, more importantly, in the deployment of the twenty first century manufacturing systems. What we have seen now in the United States is that IMS has been one of the few programs on the horizon that has forced our producers and users of Intelligent Manufacturing Systems to come together and collaborate.

I will close with one anecdote. Two years ago, one summer day in the Commerce Department, I was called up to the Secretary's suite, and when one gets the call from the Secretary, one responds quickly. I was informed that one of the big U.S. manufacturing companies had been complaining that I was holding up their effort to work with the Japanese on Intelligent Manufacturing Systems. This company was concerned about getting market access in Japan and thought such technology collaboration through R&D input might help open up the Japanese market. Fortunately, that same afternoon, the CEO of a major U.S. computer firm was in the Department and expressed his concern over the IMS program, stating that an Assistant Secretary was willing and very eager for U.S. companies to work with the Japanese in an area of great U.S. strength that would expose our lead in to our Japanese competitors. Those two desperate views of U.S. industry interests and conflicting behavior are a classic example of the pressures placed on government and the fair, brothering role government must play for the national interest. In this case, we had one whole sector of U.S. industry anxious to go forward and collaborate with competitors, and not concerned about the impact such collaboration could have on our technology assets and other sectors of U.S. industry. The "pro-company" wanted to use these "IMS" systems, and were willing to trade technology to get market access which, of course, in the case of Japan, never is realized. The "no-go" company, from a different industrial sector, believed such collaboration would be detrimental to their interests and the country at large and that we should proceed cautiously. I ultimately said to these two groups, "Why don't your CEOs get together and form a coalition and really be leaders". The response was, "Oh, our CEOs don't talk together at that level". This story does have a good ending. For over the last two years, representatives of the two sectors established the Coalition on Intelligent Manufacturing Systems ("CIMS"), which has brought together the producers and the users of IMS systems to coordinate their interests and help broker the national interest. The Canadians have established a parallel industry-led organization.

I highlight the IMS story to underscore that while we have tremendous technology assets in the North American continent, our problems still concern the deployment and organizational management of technology. I often think that competitors must wake up every morning and say, "please, Americans, do not change your anti-trust laws; keep your 1933 banking reform laws in place; keep those costly regulations in place on U.S. industry, add more tax burdens to U.S. industry and small entrepreneurial firms, and please support more commercial R&D at your universities and national labs so we have access to the knowledge and new technologies we need to commercialize in our superior industrial structures."

Surely, in the United States, as we face the next century, we have the wisdom and political will to forge a world class environment that will enable our private sector to flourish and ensure that we use our formidable technology strengths to create national wealth, rewarding jobs, and a quality of life for our children.