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Autor(en): **Arb, Christoph von**

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EFFICIENT EXPLOITATION OF ADVANCED TECHNOLOGIES
Notes on recent innovations in the United States

Christoph VON ARB
Scientific advisor
Office of the State Secretary for Science
Swiss Science Agency
Bern

Technology is the Fuel for the Economy

It is widely accepted that America has done very well over the last 40 years in expanding the general knowledge based in all fields of science. However, under growing international competition, it had, more recently, done a poor job of transforming this knowledge into economic growth and prosperity. Clinton's economic policy has targeted primarily two areas: Job creation and efficient exploitation of advanced technologies.

In this perspective, the following measures are among those found to be important in turning the tide:

1. The definition of a coherent policy comprising issues related to national security, economic competitiveness and scientific leadership

The top leadership in the White House acknowledged from the beginning the importance of science and technology for securing the country's future prosperity. In order to raise the awareness of the general public, President Clinton and Vice President Gore personally engaged themselves in widely publizised S&T activities. Strange as it may seem, they did not immediately start with new government programs. But they rapidly expanded the ones which were in line with the new policy[1].

The new policy consisted in a major shift in the perception of a government's responsibility towards technology development and transfer. Science policy, which comprises education and technology issues, was regarded as a very important element of national security. In accordance to this change of perspective, the President raised the status of his Science Advisor. Being the Director of the White House Office of Science and Technology (OSTP), Jack Gibbons, unlike his predecessors, was asked to attend cabinet meetings and became a member of the National Security Council, the

[1] With an annual budget of more than $ 70 billion, the President's Science Advisor controls a significant portion of the $ 500 billion discretionary spending of the federal government.

Domestic Policy Council and the National Economic Council. The importance of S&T was further enhanced by establishing the so-called National Science and Technology Council (NSTC) which brings together experts and leaders from outside the government to advise the President and ensure that his policies are based on the requirements and needs of industry, university, and society.

President Clinton charged Jack Gibbons of developing a coherent national science policy bearing in mind all other vital interests of the United States. The implementation of the policy is guaranteed by a new budgetary process which forces the research funding agencies of the federal government to submit their budget plan to OSTP before they reach the President for final approval. It is the Science Advisor's responsibility to make sure that S&T funding is coherent with the respective policy.

2. ***The implementation of a structural reform called "Re-invent Government" in order to increase the efficiency of the federal government by downsizing government agencies and improving the interdepartemental coordination efforts.***

NASA Administrator Goldin was one who felt the pressure the most. The International Space Station Alpha (ISSA) was as hotly debated in Congress as the other megascience project, the Superconducting Supercollider in Texas, which was terminated after more than $ 2 billion had been spent and construction was well under way. At one point it literally took the Vice President's vote to keep ISSA alive. "Faster, better, cheaper" became Goldin's motto. The President's plan called for a fifty per cent cut in NASA's staff at the Washington headquarters and a task force committee investigated which NASA laboratories could be eliminated. Similar evaluations were done with the Department of Energy Research Laboratories. While none were shut down completely, some were considerably downsized and/or had to reorientate their research work. All in all, the White House claims to have eliminated 250'000 jobs in the federal government since 1993.

By launching national programs which would engage several departments simultaneously, a joint management promised to generally improve coordination efforts among the various government agencies and help establish a coherence with respect to overarching priorities. Jack Gibbons would give as an example the Partnership for a New Generation of Vehicles, for it would involve many partners with basically diverging interests.

3. ***The invitation to industry to join forces with the government in strategic areas of the economy.***

One of the triggers for a closer collaboration between industry and government was the growing international competition. By 1990, Japan had achieved a market share in chip manufacturing larger than that of the U.S. This development had become apparent a few years earlier, and an industry consortium called SEMATECH was

established under the leadership and with financial support of the federal government. About six years later, America had been able to recapture a lot of the lost market share. Consequently, federal support was terminated. SEMATECH remained the only such example until Bill Clinton took office. He then actively fostered this form of large scale industrial cooperation, and since 1993 several new initiatives such as the New Generation of Vehicles[1], the Flat Panel Consortia, and the Advanced Battery Consortia were announced. They can all count on political as well as financial support from the federal government.

4. *The decision by the government to take an active role in the bridging of the "innovation gap".*

In contrast to a prior "hands off" policy with respect to interfering with market forces the new administration seemed poised to do what they said the European Community and other governments had done for years: strategic strengthening of the scientific and technological base in key technology areas. This decision was based on the notion that future, highly profitable markets would be technology driven. "Technology Is the Fuel for Economic Growth" proclaimed Vice President Gore, when he announced the "National Information Superhighway" initiative in 1993, an initiative which should enable every American household to profit from an Internet connection in less than 15 years. In addition, the new policy stated that it was the government's responsibility to "enable" the private sector to better exploit the results produced with public funding[2]. "Enable" meant that the government should not be directing and ordering the development and commercialization of a product or service, but rather asking industry to define its needs. Based on these needs the government a) would request the R&D institutions which receive public funding to search for specific answers, b) would discuss with industry possible joint-ventures that would take advantage of the availability of complementary infrastructure and expertise, and c) would offer incentives such as a permanent R&D tax credits to encourage industry to invest in R&D.

Some of these initiatives are described below. They give an overview of the different approaches:

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[1] It was the first time in automotive history that the three big car makers could be convinced to collaborate on a precompetitive basis.

[2] Unlike Switzerland, the U.S. government finances more than 45% of scientific research. In 1996, 54% of the expenditures were defense related, followed by health research (17%), space (11%), general science (4.5%), energy (3.8%), environment (2.7%), transportation (2.6%), agriculture (1.7%), commerce (0.6%), and international (0.3%). The low figure for commerce reflects the ongoing fight between Congress and the White House about the government's role in spurring innovation. The plan for 1997 foresees again a 46% increase for that budget item. The figures further show that "popular" fields of science, such as health research (everybody's concern) and space (national pride) receive 61% of civilian R&D funds.

- Cooperative Research and Development Agreements (CRADA)

National research laboratories receive funding in the order of several billion $ per year. These laboratories are requested to prove their efforts in know-how transfer with collaborative agreements. A CRADA would allow a national laboratory to use its own resources to do research work with an industrial partner at a precompetitive level. Should a laboratory not be successful in launching such projects, cuts in the overall budget would be the consequence.

- Advanced Technology Program (ATP)

This program aims at the last stage of development of a product or service. Any company can apply for direct funding. There are two requirements: at the end of the funding period, the product has to be ready for the market and the company has to demonstrate plausibly why and how it thinks it will be able to successfully market the new product. If an application should not be granted, the funding agency will explain to the company why it failed and how it could increase its chances in a second attempt. Joint proposals are favored[1].

- Manufacturing Extension Program (MEP)

Many small and midsized enterprises (SME) are unaware of the latest available technologies and developments which could help them increase the productivity of the company. Representatives of a network of regional offices are actively seeking to contact SME's and offer them their services. For a very low fee, they analyse the company's performance and make recommendations for improvements. In order not to compete with private consultants, the government very frequently hires them to talk to the companies.

- Small Business Innovation Research (SBIR)

This is the oldest program offering support to SME's. Congress initiated this program in 1982 by compelling every research funding agency to set aside 2%[2] of its funds for SBIR. With this money, the agencies support innovation in private enterprises in three phases: the first phase (ca. 80% of all awards) consists of a feasibility study of the technology to be developed; phase two provides funds for the further development of a technology (ca. 15% of all awards) and phase three allows a company to complete the development of a technology (ca. 5% of all awards).

The government also launched extensive targeted research programs. Multiannual programs such as the National Information Infrastructure Program, High Performance

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[1] The intellectual property rights belong entirely to the company. The funding ranges from $ 50 thousand to 15 million. In 4 years, over one thousand projects were granted.

[2] In 1995, 11 agencies provided a total of $ 900 million for SBIR projects. Each agency is responsible for selecting and funding its own projects. In 1994, 3,800 awards out of 26,000 proposals were granted.

Computing, Environmental Technologies, Human Genome Project, etc. These programs are investments in areas which are, from an economic as well as from a security point of view, vital to the United States. They are to bear fruit on a middle term basis and will secure American leadership well into the first century of the next millenium.

5. *The provision for an improved transfer of "dual use technologies"*

As described above, more than half of the federal R&D budget is defense oriented. In a post cold war era, it seemed obvious that the attention would focus more on the economic "threats". The main defense R&D funding agency DARPA[1] lost all of a sudden its "D" and was told to increase funding for so-called "dual use" technologies, with a potential for application in the civilian as well as in the defense sector. A major down-sizing process in the defense industry took place over several years. Some of the subsequent savings for the government, termed "peace dividend", were reinvested into expensive civilian high-tech projects.[2]

What are the results after four years?

12 million jobs have been created and the unemployment rate has fallen to 5.2 per cent. Despite the economic stagnation and slow growth in Europe and Japan respectively, the United States have enjoyed a stable two to three per cent growth per year. The federal deficit has consistently been decreasing to a level of the early 80's.

No doubt the United States seems to have done its homework and has arguably not been in a better position *vis à vis* its competitors in three decades. The American government followed industry which went through a major shake down in the late 80's. It made some very tough decisions and saw them through. The current success seems to prove that they were the right ones. However, the next few years foresee even harder choices. Jack Gibbons recently talked about the zero sum game. He noted that up to now, the cuts took off the fat. "Now we are going to cut into flesh and bones. That is why our actions have to be even more carefully orchestrated than before"[3].

What is the lesson for Switzerland?

- The Swiss people have to accept that it is time for a change and welcome the challenge.

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1 Defense Applied Research Projects Agency.

2 The Technology Reinvestment Program (TRP) received roughly $ 8 billion over the last four years.

3 The budget plan calls for the elimination of the deficit by 2002. During the same period, federal R&D expenditures will decrease by 5% and will have reached again 1996 funding levels by the year 2002.

- Unlike Switzerland, the United States decided in the beginning to constitute a form of government which would favor strong leadership[1]. It is in a time of crisis that a country can demonstrate its inner strength and vigour. This time has come for Switzerland. It will take a quantum leap to extricate ourselves from the present depressed mentality. Coherent and fast decision making is not only desirable but essential in a world of accelerated changes. Again, leadership is required. Does our system allow for that?

- Switzerland's present government reform is a great opportunity to streamline the decision-making process. OSTP's responsibility to secure a coherent science policy and to fine tune it with other important aspects of domestic and international policy can only be fulfilled when accompanied by the necessary power for implementation.

- Switzerland is a small country and cannot rely on a large domestic market. Our challenge will be to remain globally competitive. This means we have to find niches where Switzerland is recognized as one of the world's leaders. This implies that a concerted effort has to be made to define them. We cannot afford to continue to weaken our position with internal quarrels.

- Once a set of instruments has been chosen, the government should provide sufficient funds to permit a steady implementation until the success is complete. Short term needs should not be weighed against long term investments.

- There is an apparent lack of political will in our country to eliminate structures and activities which are no longer in line with today's policies. Nevertheless, political will is an essential element of leadership, particularly in times of shrinking budgets.

- Medias should try to encourage the people rather than bombard them constantly with negative news.

Switzerland has again and again brought forth people with great vision. We certainly need them today. But they will only stay in this country if we Swiss, and especially our opinion leaders, are ready to face the challenge.

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[1] James Madison, the Father of the United States Constitution studied the various pluralistic forms of government which existed in the late 18th century. The Swiss Confederate System was then seen by many as the ideal form of government. Madison, however, came to the conclusion, that the absence of an adequate central authority common to all confederacies had compelled the dissolution of all ancient confederacies and promised to do the same to modern ones, including Switzerland's (James, H. Hutson, The Sister Republics - Switzerland and the United States from 1776 to the Present, Library of Congress, Washington, D.C., 1991).