

Technological Cooperation For Survival

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First in a series of
perspectives on employing
technology to solve the
pressing problems of society.

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The 1970's may be remembered as the decade when mounting evidence made it impossible to ignore potential disasters in the areas of energy, food, natural resources, education and other concerns of worldwide dimension.

Possibly, it could also be the decade that will be remembered as the time when appropriate tools were resolutely put to work to solve those serious problems.

Technology is one word for those tools. In this series of papers, William C. Norris, chairman of Control Data, reflects on how to find, develop and apply technology and its many implications in our society.

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Technological Cooperation for Survival, given to the Institution of
Electrical Engineers, London, England, on February 25, 1977.

There are two inter-related ideas that I would like to discuss with you today. I consider these ideas to be extremely important – not only for me and my company, but also for you and the rest of the world.

The ideas are these: first, considering the urgency of today's world problems it is economically wrong to squander our technological resources as we are doing; and second, there are practical, readily available means to make greater use of technology to attack these problems now, before they grow to disastrous proportions.

“... technological innovation is the well-spring of new jobs, and solutions to these major problems will provide the jobs that society so badly needs.”

We have to start from a realization that the wheel is being reinvented every day throughout the industrial world, while vast amounts of existing technologies are under-utilized. This enormous waste of technical resources is a major reason why the world is lagging in the achievement of more abundant energy sources, improved energy conservation, new materials, greater environmental protection, increased food production, more efficient water conservation, better health care, more efficient education, improved productivity and solutions to many other pressing problems of society.

Additionally, technological innovation is the well-spring of new jobs, and solutions to these major problems will provide the jobs that society so badly needs. The dilemma is that this requires massive technological resources – far more than any single country can marshal.

It seems obvious, therefore, that we need to minimize unproductive duplication and to share the resulting benefits through worldwide pooling of technological effort at all levels.

This is no utopian dream. Many of the techniques have been proven in practice, but there are difficulties, both real and imagined. I'll try to highlight some of the major hindrances involved, review some successful cooperative programs and make specific suggestions for achieving widespread cooperation.

SOURCES OF TECHNOLOGY

One of the great untapped resources of the world is the wealth of information and technology buried in the libraries and laboratories of businesses, government, research institutes, academic institutions and individual inventors. But this asset isn't being used effectively because its transfer between industries, from government to business and among small and large businesses, is so inefficient. Yet official studies show that most major innovations result from application of

technologies developed in one industry to the solution of problems in another. (These studies also show that small companies are better innovators in many areas than large companies.)

Methods for substantial improvement, both in efficiency of transfer and minimization of duplication, include (1) an efficient mechanism for communicating the availability of, and the needs for, technologies, and (2) financial incentives to spur sharing of technology.

EFFICIENT MECHANISM

Efficient transfer of technology demands human-to-human communication, questioning and explanation. Unfortunately, however, the amount of available technology is both massive and totally disordered. As a result, communication between those with available technology and those who need it occurs only with incredible difficulty.

“... a more efficient mechanism to overcome the communications problem is now available...”

A more efficient mechanism to overcome the communications problem is now available in Control Data's worldwide computer-based technology exchange service. For a modest fee buyers and sellers of technology can match their needs. The problem of disorder is solved in the simplest possible way: technology is described by its owner in terms of *not* of what it is, but of what it can *do*. Correspondingly, searchers describe what they want to do, not what they think the technology should be.

NEED FOR COOPERATION

There is a growing – but still limited – recognition of the need for increased cooperation. This is evidenced by your collaboration here in Europe in aerospace, weather and nuclear fields. Then there are the Government-to-Government agreements for cooperation in various fields of science and technology.

But the number and scope of cooperative programs are much too small to solve the urgent problems of our society in a timely fashion.

Energy: A brief look at just one of these needs – new energy sources – will provide some perspective on the gap between the present effort and the pressing need. Unfortunately, it is virtually impossible for the average person, including politicians, to perceive the need for vastly increased research and development, and, in turn, widespread cooperation, to develop new sources of energy when petroleum products are generally available, albeit at prices that are causing economic disrupt-

tions in most western countries. It is easier, as some people do, to blame the higher cost of petroleum products on failures of large companies and inept governments to act in the public interest. Consequently the realities – articulated by a growing number of leading scientists, engineers and businessmen – that every possible source of energy must be investigated, are not being faced. This means that eight to ten different approaches will have to be pursued because we can't now foresee which ones will be successful. However, all will probably be needed in the long run.

It appears that the breeder reactor is the only development effort that is being funded adequately. It has high priority in the United States, Europe and Japan, however recently the United States has decided to stretch out its effort. Another reference point is that solar energy, up to now, has gotten only four percent of U.S. Government funding for energy research and development.

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Computer Industry: While the massive requirements for timely solutions to energy problems dramatically illustrate the urgent need for more cooperation, there are similar needs in many industries.

For example, in the computer industry no company has any product breakthrough advantages today, nor have there been any of significance for twenty years. Competitive success is gained mainly by doing a better job of solving the customer's problem with application software and professional services support, rather than by possession of superior hardware or basic software; and yet, the duplication in research and development in hardware and basic software is enormous. There is one significant exception, and that is the cooperative projects that Control Data is engaged in with several other computer companies, including ICL.

For industrial companies cooperation permits significant enlargement of research and development through more efficient use of resources, increasing the likelihood of a breakthrough. There is really no competitive disadvantage, as each partner is free to pursue the market in his own way, by concentrating on the unique application of the resulting products to its customers' problems.

This is not just theory – my company is experiencing the benefits of cooperation. It took us eight years to convince other companies to participate. The main stumbling block was concern over selling the same product in the marketplace. But this has proved to be unfounded.

BARRIERS

Another major concern is that of maintaining an exclusive proprietary position. In the past, companies have been able to develop new products with reasonable risk and affordable technical effort while providing an attractive return on investment. Examples in the past forty years are synthetic fibers, mending tape, instant photographs, xerography, transistors, integrated circuits and computers. For a number of reasons, neither outside technology nor cooperation has been particularly necessary to this past era of what might be termed "Proprietary Product Creation". Contributing factors in this past era were that technology was not equally advanced in all countries or as potentially available as it is today.

But circumstances are changing. First, many of the easiest things have been done. It is getting tougher to bring in new proprietary products — much more costly — more time-consuming — and much more risky. Consequently, industry has turned its attention more to product improvement and cost reduction. Therefore, concern for proprietary position now is rooted more in tradition than logic. There are reasons to want to protect proprietary elements of the marketing process but the time for it to be a major consideration in research and development has passed.

There have been few significant breakthroughs in recent years, and even when there were, the new technology has diffused so rapidly that any initial business advantage was soon lost. Thus, companies in most industries are selling the same basic product. Differentiation is achieved by designing features to apply the product better and to support the customer better.

"Too many companies are victims of the 'Not Invented Here' syndrome..."

Too many companies are victims of the "Not Invented Here" syndrome, which causes them to reject innovations developed elsewhere. And this, when coupled with the normal arrogance of large organizations, is a huge barrier.

Within most large companies the natural impulse is to want to do everything from scratch. It is unnatural to seek help or even to recognize that help is needed.

Further, in the matter of cooperation between nations, the belief persists that it is so difficult to achieve the high degree of cooperation needed for successful transfer of technology from other countries that its attempt is hardly worthwhile, despite significant contrary experience. Japan's exceptionally rapid economic growth in the post-war period is evidence that technology can be imported successfully and make a significant contribution to improvement in a country's standard of living.

Now, it seems to me, the pressures of changing economic conditions, such as the tremendous rise in the risk and cost of R&D, will force more sharing of research costs, and the expanding research capabilities in a number of countries will increase the attractiveness of utilizing, on a shared basis, the research resources of and technologies developed by others.

FORMATS FOR COOPERATION

Patterns for cooperation, I believe, are well known. The simplest and by far the most widely used is a license agreement where the seller assists the buyer in making successful use of the technology. Others which are more appropriate for the future include joint projects, turn-key plants and joint ventures. A joint venture, which usually takes the form of a jointly owned company, is most appropriate when large capital investments are required.

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How is a significant increase in cooperation to be achieved?

First, my advice for individual companies, is to try it — you'll like it.

The chief executive must exert strong leadership to achieve a cooperative mode, but of course, he first has to believe in it.

Control Data has learned that. Even at the project level the advantages of widescale cooperation are understood and practiced voluntarily primarily because the benefits have been experienced.

My company recently surveyed professional employee views on technology cooperation at the project level and found a deep conviction that it is highly advantageous. Our employees were able to identify no major disadvantages, and they believe strongly that more technology has come in Control Data's open door than went out.

As a result of our cooperative activities with other computer companies, substantial numbers of dollars have been saved. At the same time a better job has been done in developing new products. As a result of these savings, we have been able to make significantly increased investments in improved customer service. Technology cooperation is paying off handsomely for us.

Not only are our cooperative activities with other companies in the computer industry rewarding, but virtually all of our technology has been made available for use in other industries. While it is too early in this program to draw firm conclusions, there is evidence that Control Data will not only benefit from substantial added income, but that new

market opportunities for our standard products and services will be identified. Further, our professional staff is becoming more skilled and motivated as a result of the broader experience that is being afforded them in helping to transfer and apply our technology in other industries.

While there are differences between industries, I believe they are not so great as to preclude any other company from obtaining the same advantages from cooperation.

“Clearly governments should join together with private companies to pursue these projects.”

High Investment/High Risk Projects: Expanded cooperation between industries make it feasible to undertake projects that require larger investments and entail risks too great for individual companies.

But in addition, there are important problems to be solved where investment or risks are beyond private industries' capability or do not provide them with an acceptable return on the investment. Here we must keep in mind that technology developed by one company or group of companies eventually has major benefits to the entire economy, and because of these extra benefits or “Social Dividends,” support is warranted from society as a whole.

Normally the development of technology that is financed by private enterprise has a large enough payout and low enough risk so that an acceptable return on the investment in R&D is virtually assured even though a greater value is eventually realized by the rest of society. Usually, therefore, society gets from private business the products that meet that business test rather than those that address the more fundamental needs of society. Without government support, therefore, there will not be technology created to meet all of society's needs. Therein lies a major reason why private enterprise is not aggressively pursuing solutions to many of our most pressing problems.

A whole new round of innovation is necessary. The costs will be very high and the risks are great, both because of uncertain outcomes and unpredictable market reception.

Much of the initiative to establish these large-scale endeavors will have to come from the private sector. Governments seem to recognize the need for cooperation but have not shown much ability to act.

The diverse technologies created will most likely have far greater value to society than can be realized by the individual companies involved. Clearly governments should join together with private companies to pursue these projects. Management should come from the private sector and funds from the governments until experimental models can prove feasibility. Thereafter, the balance of the cost should be borne by industry.

The most experienced and effective management resides in the major business corporations of the world. They must provide the leadership – the initiative. For the very large, high-risk projects, this can best be done by a consortia of private companies and governments.

I believe that the major investment banking institutions should provide leadership in the formation of these consortia for large scale endeavors. These institutions have great credibility and they can readily cross national boundaries . . . they often sponsor mergers, and the promotion of cooperation is very similar. In the long run, the sponsorship of cooperation may be less of a departure from traditional pursuits than it now appears to be because recognition of the growing importance of technology will make it the coin of the realm.

“There is also the need to motivate those with technology to make it more available to those who need it.”

Availability of Technology: There is also the need to motivate those with technology to make it more available to those who need it. Probably the simplest way is for governments to provide tax incentives. For example, tax-free sale of technology should appeal to all concerned. There wouldn't be additional cost to the taxpayer, for without the incentive the sale wouldn't take place. New jobs would be created and the profits from the resulting production would be taxable. Also, application of existing technology produces jobs sooner and at less cost than developing the same technology from scratch.

Small Companies: Tax incentives should also be provided to encourage large companies to increase cooperation with small companies. Only the large concerns can undertake technological innovations requiring large numbers of human and financial resources. On the other hand, a combination of the greater engineering, production, marketing and financial resources of the large company with the technology base and resourcefulness of a small one, stimulates innovation.

Universities: Universities and business need a closer working relationship in order for business to apply research more effectively. On the other hand, business should be providing more support for university research. This would occur if there were more directly identifiable, socially beneficial results from university research.

Universities should play the leading role in the assessment of environmental impact of new technologies early in the developmental process. The cost should be borne by government.

“There should also be increased technological cooperation between the West and the Soviet Union.”

Soviet Union: There should also be increased technological cooperation between the West and the Soviet Union. The Soviet Union has more scientists and engineers at work than any other country and they are producing vast amounts of basic technology. They have not been effective enough in the application of technology in production. On the other hand, western countries emphasize the application of technology so there is the basis for a natural division of work in what can result in very productive cooperation.

Research projects now under way between the U.S. Government and the Soviet Union illustrate the point. One is the joint project in nuclear fusion. It was started in 1974 and is based on a breakthrough achieved by Soviet scientists. This significant cooperation has already been very beneficial to the U.S.

Another project is in magneto-hydrodynamics research. One immediate result was the saving of more than \$100 million, through joint use of a Russian test facility.

Developing Countries: The greatest need for more technological cooperation is between the industrial and the developing nations. National and international organizations have been grappling with this issue for more than a decade. The OECD has given it major attention and provided valuable perspectives on problems and solutions.

One of the major impediments to progress is that much of the technology of the industrial nations does not fit the needs of developing countries. The challenge is both to transfer existing technology and to develop new technology that is more appropriate.

Most developing countries lack adequate technical and managerial resources to identify needs and to select and manage the implementation of proper technological solutions. In addition, although technology is pivotal in the economic development process, it has to be accompanied by capital and management and applied in a supportive environment. Unfortunately a proper environment and intra-structure conducive to technological innovation is also lacking in most developing countries, so progress is too slow.

Innovation is hampered in many places by the fact that there is little opportunity for innovators to participate in rewards or because of an environment that has little understanding of what the marketplace wants or will pay for.

Clearly the most effective and timely applications of technology in developing countries will require assistance by industrial nations, but wherever possible the assistance must be in the form of cooperation in which the developing countries also contribute in a meaningful way. In other words, the motivation for cooperation by the industrial nation

must be less an act of generosity and more that of seeking business opportunities.

The major method of implementation should be joint ventures. Small to medium sized Western industrial companies make the best partners in such joint ventures with the developing countries because they are the most flexible and the best innovators.

“... the motivation for cooperation by the industrial nation must be less an act of generosity and more that of seeking business opportunities.”

There is a growing commonality in the problems of the developing and industrial countries in the areas of energy, agriculture, food processing, water conservation and health. These are all areas of great need and will provide mutually rewarding joint venture business opportunities. In addition, there are growing opportunities for universities in developing countries to make research contributions, particularly in the field of agriculture.

OTHER CONTROL DATA CORPORATION PROJECTS

There are several other Control Data programs to be mentioned for perspective on the considerable resources we are dedicating to the promotion of technological cooperation.

We sponsor seminars to provide greater awareness of important technologies. These seminars bring scientists and engineers from different countries face to face. The technologies they discuss can be indexed and stored in the TECHNOTEC data base, making them easily accessible for study during the seminar. Afterwards the technologies can be called out for examination any place in the world.

The first series of seminars was held in the United States earlier this year. They addressed Soviet technology in process control systems. The attendance was excellent and there were many cases of serious interest in the technologies.

Solar Technology: Another important Control Data program is a priority effort to collect in the TECHNOTEC data base all of the world's solar energy technology. While still inadequate and inefficiently organized, technical effort is increasing rapidly in this important field. There is a high degree of duplication of current R&D effort between countries and among companies commercializing solar technology.

Society cannot afford waste in this endeavor. With Control Data's program we expect that unwanted duplication can be largely eliminated and cooperative activities facilitated.

If any of the present owners of solar technology cannot now afford the normal fees for storing their technologies in the TECHNOTEC data

base, or if there is doubt that the program will achieve its objectives for one reason or another, Control Data will finance the submissions until budgets are available or the objectives are met. We see the need, the facility is available and now is the time to get on with meeting the need while time is still on our side.

“... the over-whelming pressures of the many urgent problems will force change in our methods sooner or later, but extraordinary effort will be required if it is going to happen sooner.”

Appropriate Technology: Another Control Data program is that of recording technology appropriate to the needs of developing countries. Our plans are similar to those for solar energy. There have been many conferences on this subject over the past ten years. The leading industrial countries have all promised support, but there isn't much progress. There is an urgent need for developing countries to be able to know what is available.

Control Data's objective is to get a significant amount of appropriate technology in the TECHNOTE data base as quickly as possible. Here again we will finance much of the cost of getting the technology into the data base in the initial stages – long enough to demonstrate the benefits. Subsequently, we expect the program to be self-supporting.

CONCLUSION

Let me conclude by noting that the background and suggestions outlined for widescale cooperation in this paper are necessarily sketchy. There are omissions and alternatives. My main objective is to highlight the need, to illustrate ways that cooperation can be achieved within our present business pattern and to stimulate serious thinking and actions.

Because it is certain that the present standard of living in the West cannot be maintained without large-scale technological cooperation, the overwhelming pressures of the many urgent problems will force change in our methods sooner or later, but extraordinary effort will be required if it is going to happen sooner.

The average public office holder doesn't want to risk advocating change – change is painful and risky and is resisted.

Most big businesses don't want to rock the boat; instead they prefer to keep doing more of the same – make the cars two inches shorter or two inches longer; put more fake walnut on the TV set or put new stripes on the tennis shoes. Big business is not disposed to share its technology and cooperate with small business.

“If widescale cooperation can be achieved sooner it may be possible not only to provide the needed jobs and maintain the present standard of living, but to improve our environment, health care, education and meet other pressing needs.”

Most university professors don't want to change – they want financial support for research to do more of what they want to do instead of research in cooperation with businesses to meet the needs of society.

These remarks are not intended to single out particular segments of our society for criticism. We have a closely knit, interactive society and one part can't change much without changes in all parts.

If widescale cooperation can be achieved sooner, it may be possible not only to provide the needed jobs and maintain the present standard of living, but to improve our environment, health care, education and meet other pressing needs.

In my judgement, there is no acceptable alternative.