

Rebirth of Technological Innovation Via Small Business

William C. Norris
Chairman and Chief Executive Officer
Control Data Corporation

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

No. 10 March, 1979

Rebirth of Technological Innovation Via Small Business

William C. Norris
Chairman and Chief Executive Officer
Control Data Corporation

This address was given to the American Physical Society on March 23, 1979 in Chicago, Illinois and was drawn from a report to the Assistant Secretary of Commerce for Science and Technology, prepared by a work group under the direction of William C. Norris.

The small business sector no longer contributes as much to economic prosperity as it did so brilliantly in the 1950s and 1960s. The loss is not just for the few who might have had the satisfaction of technological entrepreneurship; more importantly, it is a loss for all Americans who would have shared in the abundant economic benefits and would have held the myriad of skilled jobs that such pioneering would have made possible.

Job shortage in the United States is the most important consequence of our recent decline in technological innovation. The news media tell a familiar and depressing story. Jobs are at the heart of American society. But we don't have enough of them, and we aren't creating new jobs fast enough — particularly skilled jobs.

"Jobs are at the heart of American society. But we don't have enough of them, and we aren't creating new jobs fast enough — particularly skilled jobs."

The shortage of jobs underlies our blighted inner cities and poverty stricken rural areas where residents, reliant on welfare, are bereft of the means to regain control of their personal lives to rise above the squalor. It also underlies the shameful unemployment rate of nearly 35 percent for minority teenagers. (Figure 1) This means a paucity of career opportunities that will attract their commitment to self-improvement programs as realistic alternatives to lives dominated by despair, desolation and crime.

The problem we face then is not just unemployment but *under-employment*. Half of all jobs do not even require a high school education and the average education required for all jobs increased from 10 years in 1940 to only 10½ years in 1970. Most jobs that have been added in recent years call for low skills and low pay. They do not offer young people a way up the career ladder. Thus, the recent decline in technological innovation, the best creator of skilled jobs, is having a most serious effect on employment.

On the international scene, our preeminence in technological innovation is being challenged by other industrial nations. A declining share of world exports, lower rate of growth in productivity and negative trade balances in manufactured goods are clearly shown by these economic indicators. (Figure 2) Our historic strength in innovation has been the foundation of both our domestic prosperity and our ability to compete successfully in world markets. Products emerged from innovations to provide new convenience and comfort as they created jobs on an enormous scale.

With brilliant performance in the postwar years, innovative leaders proved they could play major roles in creating new jobs and contributing to the solution of economic and social problems. They were followed by a host of smaller enterprises; all of them, in turn, creating new job opportunities.

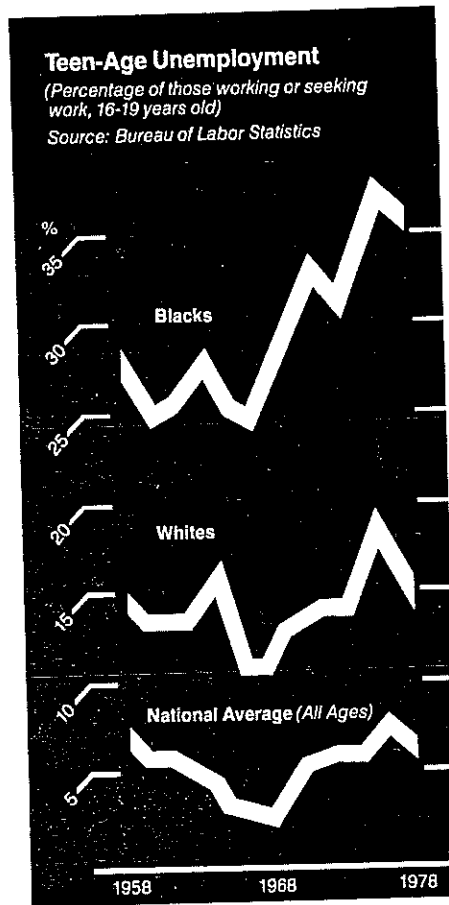


FIGURE 1



FIGURE 2

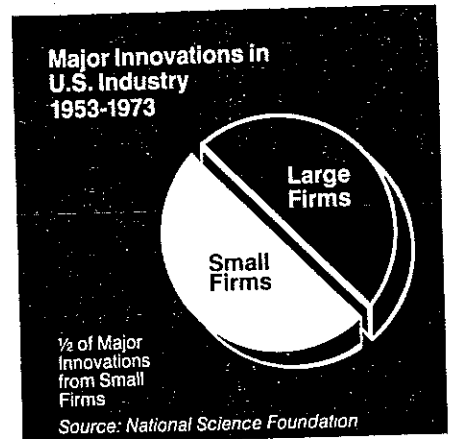


FIGURE 3

In the 1953-1973 period, about half of the major innovations of U.S. industry came from small firms with fewer than 1,000 employees. (Figure 3) And about a quarter of those innovations came from firms with less than 100 employees. But the performance of small firms has declined sharply over the last decade. The decline, until recently, has been a largely invisible crisis, not seen as clearly as the very visible problems of unemployment, urban decay and rural poverty. Its underlying causes are believed to stem from certain growth-inhibiting government policies.

"This report proposes changes in federal policy and commercial practices that can stimulate small business performance without increases in federal budget support."

At this point I should digress for a moment to mention that my presentation is based on a report titled *Recommendations for Creating Jobs Through the Success of Small Innovative Businesses*. The report

was prepared, under my direction, for the Assistant Secretary of Commerce for Science and Technology. The people (Appendix A) who joined with me in preparing this report are private citizens, each with unique and valuable experience in technology and entrepreneurship. Several have been founders of successful, small, technically-oriented firms. Others are executives in large high technology companies. Leaders in agriculture, community banking, venture capital and labor organizations are represented along with educators specializing in the social and economic effects of technology.

"The slowdown in innovation – particularly from small, technically-oriented firms – has wide-ranging social and economical ramifications."

This report proposes changes in federal policy and commercial practices that can stimulate small business performance without increases in federal budget support. Any early losses they cause in federal revenues should be offset by subsequent gains in economic activity.

Small business is defined as firms having fewer than 500 employees. Small family farms and small-scale food processors, agriculture's counterpart to small businesses, are included. Their potential for job creation, for bringing about increases in food production and decreases in food cost, underline the need for more innovation in this area.

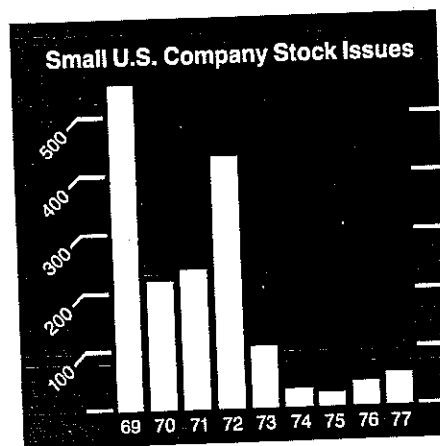


FIGURE 4

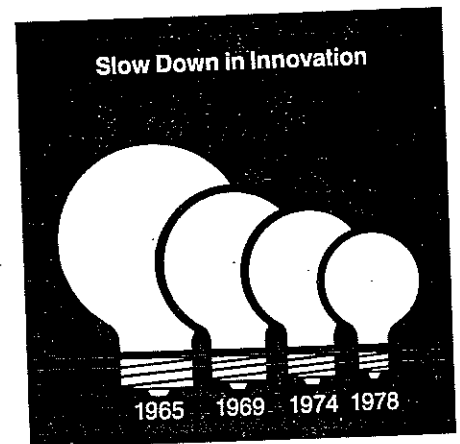


FIGURE 5

In recent years, the abrupt decline in public stock offerings for small technical companies meant the virtual disappearance of seed venture capital to support their creation and growth. (Figure 4) Federal policies can shape the opportunities available to small, technological firms. In the last decade, policy changes have had adverse effects on this vital sector of the economy.

The slowdown in innovation – particularly from small, technically-oriented firms – has wide-ranging social and economic ramifications.

(Figure 5) Unemployment has persisted at unacceptable rates. (Figure 6) Neither fine tuning of fiscal policies nor the creation of temporary, dead-end government jobs has answered the problem. A skilled job is the admission ticket to the benefits of a prosperous society and to full citizenship in economic, social and political life. But unemployment leaves marks on succeeding generations and creates explosive social problems.

Innovation plays a key role in creating new jobs. (Figure 7) From innovation comes new products that need people to design, manufacture, market and maintain them.

Innovation is a key factor in our export performance. The strength of the dollar rests on our success in foreign trade. In postwar years

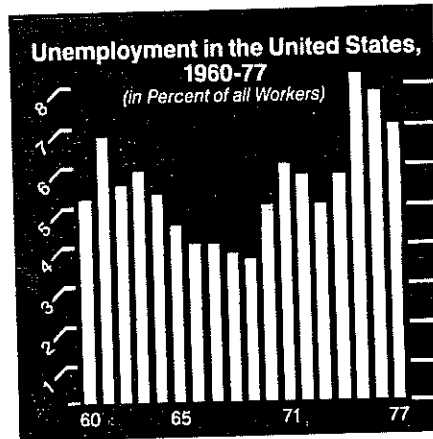


FIGURE 6

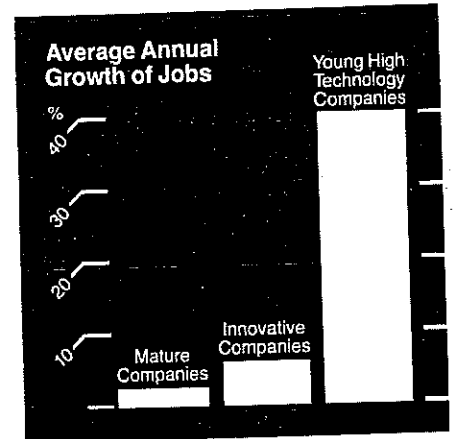


FIGURE 7

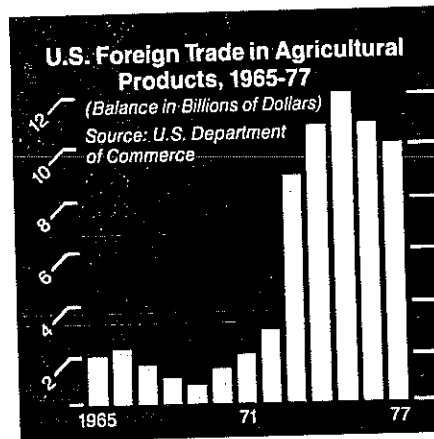


FIGURE 8

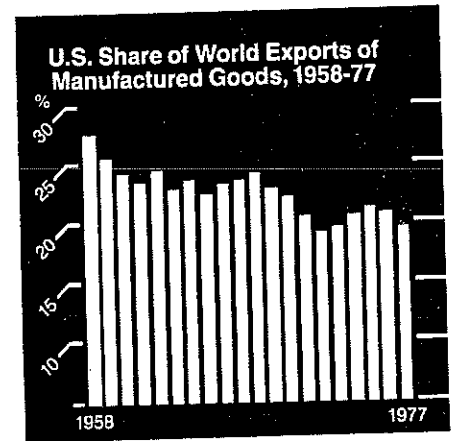


FIGURE 9

we have had trade deficits in minerals, fuels and other raw materials as well as in textiles, shoes and other products. We have covered those deficits by surpluses in technological products – aircraft, chemicals and electronics.

Agriculture contributes importantly with a trade surplus – coming largely from a high level of innovativeness shown by the American farmer and his suppliers. (Figure 8) Foreign trade underscores the

importance of including small farms and small food processing within the concept of innovative small businesses. Because much agricultural research has been directed toward large farm needs, the small farm has not realized its full potential in contributing to exports or domestic consumption.

The record of U.S. trade in manufactured products over the past 20 years is depressing. (Figure 9) While we traditionally have been a net exporter, by 1978 *imports* of these products exceeded our exports. Our trade problem, in part, lies in the decline of innovation relative to that of other countries. (Figure 10) Our traditional advantage in innovation must continue so we can remain both a successful trading and a high wage country. But we have been losing ground. Our increases in output per man-hour have lagged behind most other industrial nations. (Figure 11)

“Innovation plays a fundamental role in productivity gains...”

Innovation plays a fundamental role in productivity gains, most directly with process innovations that raise output. New products can raise productivity as when a computer or machine tool increases a firm's production.

The service sector of the economy, now two-thirds of our economic output, has had a slow rate of productivity increase. But reductions in clerical costs by using computers and office machines show what

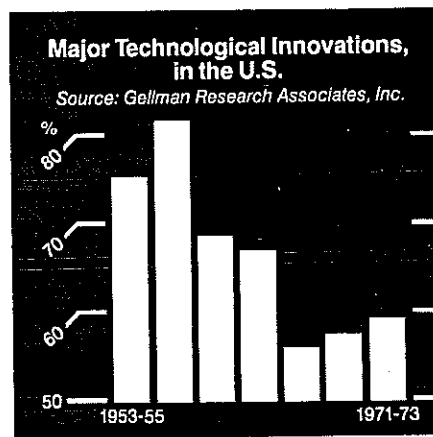


FIGURE 10

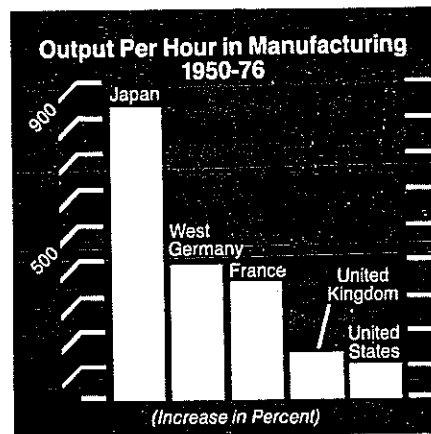


FIGURE 11

can be achieved with new products and methods. Innovation thus is of critical importance in the growing service sector.

While causes of stagflation – high prices and high unemployment – are not fully understood, a declining rate of innovation intensifies stagflation. (Figure 12) With innovation, marked price declines occur.

For example: The price of a long distance phone call in 1970 was half of its 1950 price; a transistor in 1965 was 1/100th of its 1959 price, and the 1977 price of standardized calculation on a computer was one percent of its 1957 price. Such sharp price reductions contribute to price stability by offsetting increases elsewhere in the economy.

“... successful innovation requires a combination of market demand (need), technical feasibility, and commitment of financial support.”

Innovation also has made American agriculture the most productive in the world. The American farmer, who fed seven people in 1900, today can feed 55. (Figure 13) But this gain has come from the intensive use of large-scale capital equipment; fossil fuels, principally oil, and chemicals. Agricultural innovation is urgently needed for farming methods that are less capital and fuel intensive and more conserving of natural resources. And we need research to make the small farm and small food processor more productive.

Small innovative enterprises can play an important role in renewing blighted inner cities, improving the environment, developing energy alternatives and conserving resources with activities like solar energy installation and maintenance or computer-based training and education.

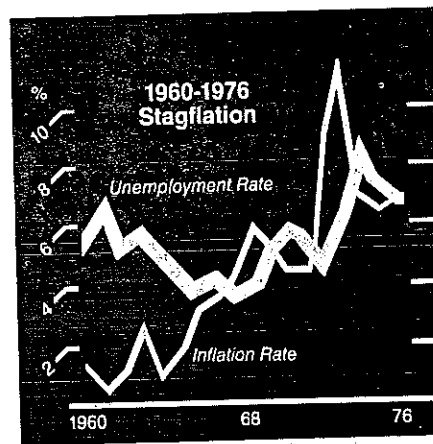


FIGURE 12

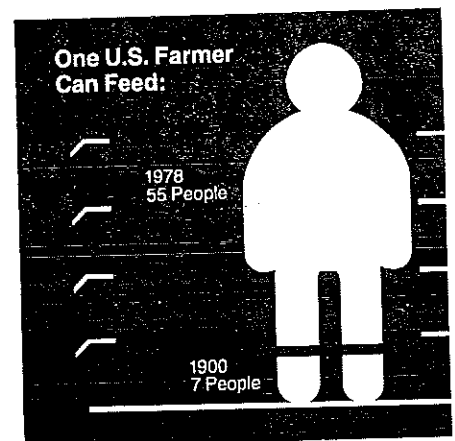


FIGURE 13

To meet pressing economic and social concerns, measures are recommended that can pay off to society by helping small enterprises regain their previous economic vitality and by fostering the viability of the small family farm and food processor through technologies requiring less capital and using fewer natural resources.

Concerns must span the entire spectrum of requirements for successful innovation – from the inception of research and development to the widespread use of a new product, process, or concept. One must then look well beyond research and development to encompass the introduction and diffusion of an invention through its commercial application which creates jobs, increases productivity, and adds to exports.

Thus, successful innovation requires a combination of market demand (need), technical feasibility, and commitment of financial support. This combination ultimately is manifested in the establishment of all of the producing and marketing facilities required for national and international distribution of the product or service. Hence, consideration must include not only the role of scientist, engineer, and inventor, but also that of the financier, the production craftsman, and the marketing person; all are involved in bringing an invention into widespread use.

RECOMMENDATIONS

Recommendations are designed to reshape government policies so they become less of a handicap to small businesses; and to do this with no increase in federal spending.

The first concern is to increase availability of seed venture capital for small enterprises. Increases in capital gains taxes have made it harder for small businesses to obtain capital. Since 1970, successive changes nearly eliminated the difference between tax rates on earned income and capital gains. The 95th Congress recognized this problem by reducing capital gains tax rates. Yet considering the risks of small technological businesses several additional changes are required. Therefore:

Recommendation One: A further rollback to the 25 percent rates of 1969 on the sale of stocks, wherever such stocks have been held for more than three years; and with a rate of 10 percent for capital gains of investors in the smallest enterprises (with less than 100 employees at the time of purchase).

Recommendation Two: Defer capital gains taxes if the proceeds of a stock sale are reinvested within one year in small business.

Similar to the roll-over provision on sales of homes, Recommendation Two would allow diversification of risk for investors while it encourages additional investment in small business formation.

* * *

Small businesses have trouble securing capital for growth during their early years and high tax rates on profits leave little for reinvestment. More small businesses could survive if tax rates on profits were reduced. Established companies can deduct expenses for early phases of innovation, but new small firms with no profits do not have this advantage. Although losses can be carried forward five years, the most promising technology may take longer to pay off. Therefore:

Recommendation Three: Reduce tax rates further on net earnings and extend carry-forward provisions for start-up losses to 10 years.

* * *

Small, innovative companies cannot pay salaries competitive with large firms. The incentive stock option was a successful, widely-used method to attract and retain key employees and allow them to defer taxes on optioned stock. Its elimination in 1976 has unduly penalized key employees of small firms who have to sell stocks in unfavorable markets. Therefore:

Recommendation Four: Restore the qualified stock option plan that permits deferring taxes to the earlier of either the year of sale of the underlying stock or 10 years after the grant of the option.

* * *

Funds for investment are increasingly under the control of institutional investors. Pension fund managers, for example, control about \$200 billion in assets. Fund managers often limit their investment to blue chip stocks. Amending the Employee Retirement Income Security Act could open up a new source of capital for small firms. Therefore:

Recommendation Five: Rewrite the ERISA "prudent man" standard to make it clearly apply to a total portfolio of pension fund investments, rather than individual investments and allow fund managers to invest up to 5 percent of their assets in small firms.

* * *

Small innovative firms are increasingly burdened by state and federal regulations. Because innovations involve new products, services and processes, they are the most likely to encounter regulatory delay and uncertainty. Lacking the resources of large businesses, managers of small firms divert their efforts to regulatory compliance. A partial solution lies in creating regulatory advisory services – themselves small, profit-making businesses – who can develop computer data bases and other expertise for coping with complex regulations. Therefore:

Recommendation Six: Allow a double deduction from the income tax of small businesses for their payments to regulatory advisory firms.

* * *

An enormous volume of information and technology exists in our universities, government departments and large businesses. Much lies dormant and little is transferred to small enterprises where it could be transformed into new products and services. Small businesses cannot afford to be self-sufficient in technology, and our society cannot afford to let technology lie idle.

About \$5 billion of research is performed annually by universities, some 70 percent financed by the federal government. A well-defined program to transfer technology to small business is urgently needed. Computer-based information storage and communications systems can be important elements in technology transfer. When an idea for innovative technology occurs to a scientist in the course of a research project, a sponsor can be sought by listing the idea with a computer-based service. Those seeking innovations can use the same service to explain their needs to scientists. This interaction greatly increases the chances that the idea will be used. More importantly, it makes innovation possible in response to a combination of market pull and technology push instead of just technology push.

Experience teaches that the most successful and least costly innovations are those where there was early linkage between the idea and the needs of the marketplace, because development could then be properly guided by interaction between researchers and users.

Although the federal government spends over \$1 billion a year to disseminate its R & D results, small businesses have difficulty in getting these results. Agencies like the U.S. Department of Defense who rely principally on R & D documents as the means of transfer are the least effective in technology diffusion.

In contrast, the U.S. Department of Agriculture, with its extension service field agents in direct contact with farmers, has the largest and most successful program of technology transfer. Agriculture spends about 50 percent of its R & D budget on technology transfer whereas other agencies spend as little as one percent or less.

A final observation to be made on government and university technology transfer activities is that in all cases the process begins after the research and development program has been completed. As noted earlier, however, the most successful industrial innovations are those where there was an early linkage between the idea and the marketplace, so that the development can be properly guided. Therefore:

Recommendation Seven: Each federal agency should allocate 5 percent of its R & D funds for technology transfer programs. These programs should include incentives that encourage individual researchers to identify commercial application.

* * *

Underutilized technology also exists in business firms. Most firms use only part of their stock of technology in their own commercial activities. The remaining, unused technology may have commercial applications elsewhere in our economy. Even more importantly, firms utilize technology in one product that may have application in other products. The concern for proprietary protection is a major and legitimate constraint on the use of a firm's technology.

Both financial and social incentives should be used to stimulate large companies to make their technology available to small companies. Private technology most frequently is transferred and used as large firms spin off small businesses. The capital gains rollback, recommended earlier, would provide the tax incentive to encourage spin-offs with resulting technology transfer and job creation. Therefore:

Recommendation Eight: While technology transfer is both socially and economically desirable, it is expensive and so must be encouraged by tax incentives. We also recommend working toward a national policy identifying the sharing of technology by large firms as an obligation to society.

This is a reasonable gesture by any company, because all technology is in part a product of our educational system and diffusion of knowledge from the technical efforts of other organizations.

* * *

One recommendation concerns redirecting R & D spending toward small businesses.

Recommendation Nine: Increase federal R & D funds going to small business by requiring federal agencies to allocate at least 10% of their R & D funds in 1% increments over a ten year period to small business.

* * *

Small firms also may encounter temporary reversals that force R & D cuts to meet more pressing financial needs.

Recommendation Ten: Allow small businesses to establish and maintain an R & D reserve in their profit years, on a tax deductible basis, for use in times of financial stress.

* * *

More must be done to counter steeply rising costs of food. An important factor is that per-acre yields of wheat, sorghum, maize, soybeans, and potatoes have not increased since 1970. Before then, productivity had increased through massive use of fossil fuels for cultivation, irrigation, fertilizers and pesticides.

Since 1970, costs have risen rapidly and problems of water shortage and environmental pollution have increased. Viability of small farms and small scale food processing requires new technologies that are less fossil fuel and capital-intensive. Technology is the key to improving their efficiency.

Existing equipment and processes illustrate the potential.

- The Ball Company is marketing energy-efficient canning equipment that fits into 750 square feet.
- Solar technologies are emerging that make small-scale crop drying more efficient.
- Small-scale sprinkler systems are being developed. Tests indicate they can provide a 15 percent savings in energy and a 20 percent savings of water.
- A very significant experiment is the model farm at Tuskegee Institute where the potential annual net income from diversified high-value crops is \$20 to \$35 thousand.
- Aeroponic technology now being developed is a more productive method of growing than the usual greenhouse method. A computer controlled feeding system senses the need for nutrients and monitors the feeding. Therefore:

Recommendation Eleven: Redirect research and development to enhance the efficiency and income of small farms and small-scale food processors.

The small-scale equipments developed from this effort are needed as well by developing countries. These efforts can therefore be an important source of exports in years to come.

* * *

Among industrial nations, the United States has been the least export-minded. Fewer than eight percent of U.S. manufacturers export and these are principally large firms. Small firms lack the know-how to find and penetrate foreign markets and probably cannot afford to buy the knowledge.

A new private sector organization that shares the costs of reaching export markets among several small firms could help make foreign trade profitable for small businesses. The most promising are small business export trading corporations; private companies that serve at least three small business clients with foreign trade expertise.

Recommendation Twelve: Special tax incentives, consonant with GATT guidelines, are needed initially to help small firms overcome the initial costs of entering export markets.

* * *

To summarize, twelve changes in federal policy and commercial practices are recommended to increase the availability of capital and management expertise for small businesses.

1. Reduce the capital gains tax rate on small businesses.
2. Defer capital gains taxes when stock sales are reinvested in small firms within one year.
3. Ease corporate tax rates on small business and extend the carry-forward time for startup losses from five to ten years.
4. Restore the qualified stock option plan for key employees.
5. Rewrite ERISA's prudent man standard and permit pension fund managers to invest up to five percent of assets in small firms.
6. To reduce the burden of small firms' compliance with government regulations, allow them to deduct twice their payments for regulatory advisory services.

To stimulate the diffusion of technology developed in government and large business research and make its application more effective for small firms:

7. Allocate five percent of federal agencies' R & D funds for technology transfer.
8. Reward private owners through changes in the tax code for technology transfer to small business and establish a national policy that encourages companies to make their technologies available to others.

To increase the amount of research and development performed by small business and increase its utility for small farms and small scale food processors:

9. Require each federal agency receiving R & D funds to allocate at least 10 percent of these funds to small business.
10. Allow small firms to establish and maintain a tax deductible reserve for R & D use in times of financial stress.
11. Redirect research to develop technology for the improvement of small farms and food processors and to make food production less capital and fossil fuel intensive.

Finally, to stimulate the export performance of small business,

12. Encourage the creation of small business export trade corporations and allow an additional deduction of expenses for serving foreign markets.

To assist this program, the Department of Commerce is urged to support two allied efforts. First, to encourage the creation of community cooperation offices — nonprofit, privately-supported corporations — which will foster the startup and growth of small businesses. The major segments of society, including state and local governments, large and small business, academia, religious organizations, labor unions, and farm organizations should be supporting participants.

“To assist this program, the Department of Commerce is urged to support two allied efforts. First, to encourage the creation of community cooperation offices . . .”

The community cooperation office assists small businesses in getting started by providing seed venture capital and in profitable growth by furnishing assistance in locating needed technology and consulting help. Cooperation offices should be informally linked with the Department of Commerce so that their experiences and concerns can be most effectively shared. The Minnesota Cooperation Office for Small Business represents a prototype for consideration by other states.

The second Department of Commerce effort should be a program to help educate the American public as to the importance of technological innovation and the vital role of small business firms.

"...and second, a program to help educate the American public as to the importance of technological innovation and the vital role of small business firms."

Action on these recommendations can restore the vigor and vitality of our small businesses without any increase in federal spending. Historically, small businesses have generated the larger share of industrial and agricultural innovations. They can again.

APPENDIX A

S
R
I
:
:
:

Work Group Membership

WILLIAM C. NORRIS	CEO, Control Data Corporation
SHERMAN R. ABRAHAMSON	Special Assistant to the CEO, Control Data Corporation
JOHN H. CARTER	Director, Semiconductor Materials, IBM
DONALD W. COLLIER	Senior Vice President, Corporate Strategy, Borg-Warner Corporation
WILLIS K. DRAKE	CEO, Data Card Corporation
JOHN FREIVALDS	Project Manager, Experience, Inc. (Agricultural Consulting and Research)
DANIEL S. GREGORY	CEO, Greylock Management Corporation (Venture Capital)
VERNON H. HEATH	President, Rosemount, Inc.
HERBERT C. JOHNSON	CEO, Electro/General Corporation
RICHARD S. MORSE	Consultant to and Director of several U.S. business firms
MARILYN NELSON	Chairman, Citizens State Bank of Waterville, Minnesota
MERTON J. PECK	Chairman, Department of Economics, Yale University
NEIL SHERBURNE	Member, U.S. Department of Labor Executive Reserve and Regional Manpower Advisory Board
ROBERT TAPP	Chairman, Humanities Program and Professor of Religious Studies, University of Minnesota
THEODORE SCHELL	Department of Commerce Liaison