Back to the Countryside Via Technology

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Fifth 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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This address was given to the National Agri-Marketing Outlook Conference on November 8, 1977, in Kansas City, Missouri.

Farming is a subject that is particularly close to me. I grew up on a farm in south central Nebraska. We raised corn, cattle and hogs.

We almost lost that farm during the great depression, in the summer of 1934, when Nebraska was in the throes of the most devastating drouth ever to sweep the Great Plains.

I was a senior in engineering school at the time and was called home, after dad died suddenly, to run the farm. Feed was scarce. We were about to lose our fine herd of Herefords that we had worked for years to build.

It was a tragedy that many farmers on the Great Plains were suffering that year.

Our herd was too valuable to sell for rock bottom prices in a glutted market. A way had to be found to feed them over the winter. To sell them was to lose the farm.

Then one hot summer afternoon I came upon the answer – the one thing that was thriving on those hot, dry fields was thistles – lush green Russian thistle weeds blantantly growing amid the seared and shriveled corn.

I remembered as a small boy, helping my dad feed the cattle and noticing a cow pick an immature thistle out of the green alfalfa and eat it.

So we decided to cut and stack the tender thistles before their prickly heads matured. Neighbors thought we were nuts; hence it was difficult to find help. No one wanted to risk being laughed at.

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But the thistles were finally cut, stacked and fed as roughage to the cattle through the winter, supplemented with concentrated protein feed.

And the cattle made it through the winter. It rained the following spring and we saved the farm. I still manage the farm, principally by phone, from Minneapolis.

Another important part of my life is computers. I started a computer company – Control Data – twenty years ago. Last year Control Data had revenues of over $2 billion . . . we operate in thirty-three countries and employ more than 45,000 people.

Twenty years ago computers seemed to be a long way from agriculture, but not any more. Today farmers are being helped in many and varied ways including aid in deciding on what crops to plant, optimum mix for livestock feed, when to irrigate and financial management. And as will be noted later, computer technology is the keystone in the "back to the countryside" program.

RATIONALE

With that brief background, let me start to establish the rationale behind my remarks today by noting the reversal of the longstanding country to city migration. For example, between 1970 and 1975, population of non-metropolitan areas in the U.S. is estimated to have grown about twice as fast as that of the nation's cities. This is a reversal of the trend that has been going on for decades. It is not yet a back to the farm movement. Farm population continues to drop. And although the trend back to the countryside will probably continue, without proper planning, fuel shortages, unemployment, educational, health care and other serious problems will develop.

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Migration back to the countryside, including back to the farm, if encouraged by national goals and properly managed, along with appropriate research and development, would have great benefits for our society. Unemployment would be materially reduced, food production increased while production costs decreased, and greater conservation of natural resources and more environmental protection would be achieved along with providing a greater availability of a life style of growing popularity. Virtually all segments of society would profit in one way or another.

There are many elements of change already intrain affecting agriculture and food processing, that not only support this thesis, but dictate its adoption. These include the inexorably rising costs of energy, decreasing availability of fossil-based fuels and fertilizer, rising equipment and land costs, the growing scarcity of water, environmental degradation and diminishing returns from many of the present directions of agricultural crop breeding research.

The present highly centralized, hugely capital-equipment-intensive, fossil-fuel-dependent and environmentally destructive methods should now start to give way to the more decentralized approaches of smaller farms and smaller food processing units that use alternate sources of energy.

This scenario does not represent the most prevalent views which extrapolate the past and predict the eventual extinction of the small farmer. But we now know that in many areas the future can not replicate the past and if we plan for and manage the changes that are already emerging, great benefits can be achieved sooner. Let me analyze each major element of change, starting with energy.

ENERGY

The rising costs and decreasing availability of fossil fuels are producing a wide range of economic consequences that will increase in severity. Some have already reached the critical stage. For example in the

Trans-Pecos region of Texas, a vast and arid region requiring irrigation for crop raising, water has to be pumped three hundred feet or more to the surface. In 1974, natural gas, the fuel used for pumping, was $0.34 per thousand cubic feet. In 1976 the cost was $1.85 and at that level very little can be grown at a profit.

Pump irrigation is a very heavy consumer of energy; for example, in Nebraska a center pivot irrigation system requires roughly ten times the fuel to irrigate a field as is needed to till, plant, cultivate and harvest a corn crop.

In addition to its cost, there is also the availability of petroleum to consider because many areas rely on it where natural gas is not available. The OPEC embargo has proven that the U.S. can be shut off and rumors of threats have occurred since. Ultimately as world supplies dwindle, petroleum will have to be conserved for priority uses, such as air transportation.

Development of alternative energy sources must be accelerated. Solar energy, windmills and refuse converters are all feasible alternatives as reliable and economical sources for agricultural use.

There are many new possibilities such as that of combining energy generation with plant growth enhancement; for example, one is a system with solar heat collecting and storage in which mirrors reflect light on heat storing materials. The heat is then converted to electricity. When the sun is not shining, the mirrors are used to reflect artificial light over growing crops, thus producing yields greater than normal.

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These kinds of systems for generating energy and enhancing the growing process will tend to be of an intermediate scale not highly automated but requiring considerable human involvement.

FERTILIZER

Since much of the nitrogen fertilizer presently used is derived from petroleum products, there are the same problems of availability and cost of fertilizer as those pertaining to energy. In addition, there is the serious pollution problem of run-off from fields.

Scientists are urging that increased research efforts be made to advance nitrogen fertilizing means not dependent on fossil fuels, such as development of a synthetic nitrogen-fixing process using renewable resources.

Many more sources of stimulants for plant growth must be researched. For example, the Soviet Union is experimenting with lased water. A preliminary report indicates the water treated with a laser beam can

raise crop yields by fifty percent. Also in the Soviet Union, experiments are being made to use furnace ash from power stations that is magnetized as fertilizer. Results indicate heavier yields of some root vegetables. In Israel heated water ripens cucumbers a month earlier.

These experiments are examples of the many feasible directions for research effort.

WATER

Agriculture is placing increasing demands for water as the amount of land irrigated is increased. At the same time consumption is rising rapidly in industry and a growing population is using more and more water per capita.

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The recovery of oil from oil shale and tar sands which will surely have to be done in the future will require enormous amounts of water.

Plainly, increased efficiencies in the usage of water are mandatory and they must be sooner rather than later to avoid serious crunches.

ENVIRONMENTAL

Chemicals used in insect and weed control are also increasing rapidly in cost and there are growing objections by environmentalists to their continuing intensive use, because of pollution and wild life destruction.

Run-off pollution from fertilizers and chemicals is greatest where crops are planted in rows. Yet today's form of large-scale mechanization for corn, cotton and soybeans could not be used otherwise.

Soil erosion is an even more serious problem with row crops. Not only is there the loss of top soil, but erosion accounts for more than fifty percent of the pollution in our streams.

LARGE VERSUS SMALL FARMS

Land costs have risen manyfold in recent years, in some areas five or six times. Today's land costs and interest rates can in many cases double the cost of production. Rising land costs are making it difficult for young people to start up in farming. In recognition of this, the Minnesota legislature approved a law in 1976 authorizing the state to guarantee ninety percent of loans for land purchase. The state also pays parts of each interest payment and is repaid the interest subsidy at the loan's maturity date.

In the past the rising cost of land has been offset to a considerable extent by more efficient equipment and increased yields obtained through plant breeding, crop specialization, fertilizers, chemicals and irrigation. Constraints developing in these approaches have already

been pointed out, except for farm equipment. But here too they are developing.

"Rising land costs are making it difficult for young people to start up in farming."

One of the most important sources of growing productivity in U.S. agriculture has been the greater technical efficiency achieved on large farms as compared to small farms through the use of large machinery and large tractors, particularly the latter. A four-wheeled drive with horsepower of 300-350 is coming into wide use and it performs more work per horsepower than the conventional two-wheeled tractors.

Speaking of tractors reminds me of an old, old story about the enthusiastic young tractor salesman and the wise old farmer.

The salesman was driving one day through the countryside looking for prospects. His head was full of facts and figures about why farmers should buy new tractors.

Then as he was driving by a field he saw an amazing spectacle and braked his car to a screeching halt.

"If we don't move rapidly in developing alternative sources of energy we are going to have less and less to say about availability, and foreign nations will be deciding who gets their oil and under what terms."

He leaped out and hailed a farmer who was at work plowing his field. Pulling the single bottom plow was a bull the farmer had appropriated from his dairy herd.

As the salesman approached, the farmer reined in the bull and sauntered over to the fence. He listened intently to the salesman who gave him all the reasons why it was not economical to use a bull to plow a field, especially when efficient modern new tractors were available.

After a few minutes of quiet listening, the farmer interrupted the enthusiastic young man and said:

"Oh, hell, I know all about tractors. But I'm teaching this bull that there's more to life than just tearing up fences and chasing the neighbor's heifers."

Like the farmer's bull, even though we may not want to, we must consider change. The starting point is the cost and availability of petroleum, which must now be reckoned with in considering equipment of the future. Already almost fifty percent of the decision on availability is beyond our control because we are importing almost that high of a percentage of petroleum. Losing that much control is serious enough. If we don't move rapidly in developing alternative sources of

energy we are going to have less and less to say about availability, and foreign nations will be deciding who gets their oil and under what terms. It is likely that the lowest cost, most available alternative power sources initially will be electricity derived from solar, wind, nuclear or hydro sources. A whole new round of development will be required to adapt mobile power units to electricity. At first, only relatively small units powered by electricity will be feasible.

The ultimate availability of more appropriately sized farm equipment powered from alternate energy sources would help to reverse the present trend toward larger farm units with capital-intensive methods back to smaller units in a number of areas of farming.

LOWER COST FOOD PRODUCTION

Given the inexorably growing constraints of petroleum, fossil-based fertilizer, water, environmental and land costs, it is imperative that the costs of production be cut drastically. This is most likely to be achieved in the long run by moving towards smaller farm units using more labor-intensive methods. I am not talking about a mule and forty acres or even a bull and forty acres. In other words – not back-breaking labor, but human involvement in coordinating and directing many smaller scale activities. Also implied is less specialization and movement toward integration of a variety of crop, livestock and other activities.

OTHER COUNTRIES

It is essential to include a few highlights with respect to other countries in this review, in order to help distinguish and validate the correctness of the directions proposed as well as to establish the basis for more cooperation among nations.

There is growing evidence in other industrialized countries of similar trends reversing the drift from the land. In 1975 for example, the number of farm workers in England and Wales went up.

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In the developing countries, green revolution agriculture is also highly fossil fuel intensive, especially with respect to fuel, fertilizers and pesticides. Thus there is a significant and growing similarity of the research and development needs of the industrial and developing countries that include alternatives to fossil fuel energy, more natural types of fertilizers, non-chemical pesticide control, water conservation, and more appropriately-sized equipment.

FOOD PROCESSING AND PREPARATION

While the preceding remarks have been directed primarily to agriculture, most apply to food processing as well. Studies show that the

processing, packaging, distribution and transportation of food requires as much or more energy as growing the food itself. Much of the present processing and packaging is done in highly centralized operations.

The stage is being set for decentralizing important segments of food processing into smaller units that will be more labor-intensive, located nearer the consumer and using packaging which is less expensive and environmentally degradable. The recycling of metal containers and use of returnable bottles are two areas where this is already starting.

Food preparation is another big expender of energy: for example, refrigeration and cooking account for energy usage about equal to that of food processing.

INFORMATION AND TECHNOLOGY

A critical need today and the keystone to success in moving to smaller farms and smaller food processing units is information and technology more readily available and applied more effectively. By technology I mean knowhow – how to make two stalks of rice grow in place of one is know-how, or technology, as is the design of a crop dryer. Obviously technology extends over a vast range.

There is a massive, urgent and worldwide need in the agricultural community for finding information faster and in obtaining and using technologies more efficiently.

What I mean is the kind of information system that will tell a farmer why he should plant soybeans or some other crop instead of corn in a given situation, or how to use less water in irrigation, how to customize farm machinery, or provide diagrams and descriptions of solar heating devices and wind-powered electricity generation, or electrical troubleshooting for farm machinery, and so on.

"There is a massive, urgent and worldwide need in the agricultural community for finding information faster and in obtaining and using technologies more efficiently."

The agri-business sector needs a massive dose of technology and information supplied unlike this country has ever provided before. This need grows ever more urgent. At the start of this talk I alluded to my earlier experiences with the great depression and it's ironic that I now see agricultural income, in terms of what it will buy, at a level not far from that experienced in those dreary days.

Computer technology has advanced to the point where it can meet these information and technology transfer needs. Control Data's AGSERV, TECHNOTEC and PLATO computer-based education services are specifically responding to them today.

AGSERV is a more accurate and timely service for crop information that is being developed. It combines existing public agronomic and

weather information with our data plus that of a user to produce area unique reports and forecasts. In other words, when fully developed a farmer will be able to get a report or forecast whenever he wants it that is tailored to his area and his knowledge.

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TECHNOTEC is a worldwide computer-based communications information and technology transfer system. Data bases on both agricultural information and technology are being built up. For example, if an improvement in irrigation is developed in Israel, information on it will be in the data base and farmers in the U.S. can search it out and learn about it.

PLATO CBE is for training and education. There are courses now available in farm management and many under development, such as courses in animal breeding, milk marketing, genetics, ration formulation, and so on.

Information, technology and education offerings are delivered via terminals that will be conveniently and economically accessible by every farmer or small agri-business person.

The information and technology in the TECHNOTEC data base can be accessed today via a low-cost terminal over a telephone line. It is feasible today for some individuals or a group of farm persons to lease or own and operate a low-cost terminal.

There are not yet enough CBE courses available to warrant home ownership of a PLATO terminal, so that delivery of education is best achieved now by PLATO terminals in cooperative offices, chamber of commerce offices, extension offices, and privately operated learning centers.

"It is feasible today for some individuals or a group of farm persons to lease or own and operate a low-cost terminal."

Control Data is implementing a program of achieving nationwide delivery of TECHNOTEC and PLATO CBE via those places. However, as soon as enough courseware is available, it will be in the economic interests of the average American farm family to own a PLATO terminal, both for education as well as for rapid access to information and technology. The courseware can be written within the next three or four years.

This increasing accessibility and availability of information, technology and computer-based education will by itself give great impetus to migration back to the small towns and farms by making it possible to reduce drastically the amount of travel required by rural people in seeking occupational, business and educational alternatives; for example, it will be feasible for many kinds of industrial work to be performed in the home or in small operations near by.

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But this impetus is not enough by itself. One important need is a set of national goals that support the development and use of alternatives to the present fossil fuel intensive, huge capital investment and environmentally destructive farming methods.

The formation and operation of smaller units with appropriately scaled equipment should be encouraged as well as methods requiring a minimum of fossil fuels and involving more human labor.

Research should be redirected to support these goals. Much of the research and development today primarily benefits only the large-scale farm using fossil fuel intensive, large capital equipment, labor-saving methods. Huge and automatic animal feedlots, gigantic tractors, multiple row tilling and planting machinery, and plants which have characteristics bred into them to best accommodate to the machinery are examples of this R&D.

"Tax incentives are needed to motivate those with technologies relevant to these tasks, to make them more widely available to those who need them."

There is growing evidence that crop yields are leveling off. This requires not only a substantial increase in the level of research but new directions as well. Of great importance is the establishment of cooperative research programs with other countries because the timely achievement of the goals will require a massive research effort far beyond the resources of any single country.

Developing Countries: Developing countries can make major contributions because virtually all of them have universities and institutes with research capabilities, particularly in the fields of agriculture and solar energy. The U.S. is committed to provide substantial aid to developing countries and cooperative programs can be far more acceptable and productive with developing countries contributing to problem

solutions, than unilateral aid that is too often ineffective, resented and viewed as charity.

Increased Cooperation: Also of vital importance is expanded cooperation among businesses engaged in agri-business and food processing to accelerate the technological innovation required to develop and build the many new equipments and processes required to establish smaller, decentralized plants less reliant on intensive use of fossil fuel energy. Tax incentives are needed to motivate those with technologies relevant to these tasks, to make them more widely available to those who need them. For example, a 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. Also, application of existing technology produces the end result sooner along with the attendant new jobs at less cost than developing the same technology from scratch.

SUMMARY

Establishing a program whereby agriculture and food processing resolutely move toward smaller units is not only the best one for agriculture and food processing, but such a program would contain major benefits for all sectors of society. It would provide for greater conservation of natural resources, better environmental protection, the increased availability of a life style of growing popularity, and the creation of a vast number of new jobs.

New job creation may be the most significant benefit of all because the unemployment problem will become more critical in the next ten years as another twenty million new jobs will be required, the largest increase in our history. Thirteen million were created in the last ten years. Then there are the further massive reductions in manufacturing jobs by industrial robots that will begin to come into widespread use in the 1980's.

National goals. More cooperation. Capital availability. And tax incentives. All are needed to establish a program to reach these objectives. But most important is the involvement by all sectors of society.

I am personally committed to help structure regional organizations that pull together and focus efforts in establishing and implementing the program.

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I have had many meetings with leaders in business, government, education, labor unions, foundations and churches, to gain understanding and support. For example, later this month I will be speaking on this subject at the United Church World Ministries annual meeting and to a group of business leaders at a Minneapolis conference. There

is great interest and I am confident that a national program *will* become a reality.

A timetable of twenty years for achieving significant results appears reasonable. This is an estimate based on my experience in developing new concepts to the point where significant benefits are produced. For example, it has taken twenty years to bring computer-based education into fruition. The development of the technology and facilities for TECHNOTEC also took about as long.

"The vast majority see tomorrow as it is today, and find it unpleasant even to think about change. Change usually isn't as comfortable as the status quo."

The pattern of these and other significant developments with which I have been associated have also been similar in another respect – widespread skepticism in the early stages. In addition, one's sanity is questioned. And there are charges of recklessness. The vast majority see tomorrow as it is today, and find it unpleasant even to think about change. Change usually isn't as comfortable as the status quo.

But the status quo today isn't as comfortable as it used to be. There is deep concern and widespread uneasiness all over the world about unemployment, underemployment, energy, pollution, and other major societal problems. The old ways aren't working. That is increasingly obvious.

What isn't so obvious is why? But people are much more prone to listen these days. They exhibit less skepticism and more apparent willingness to adopt a new concept. In addition, there is a widespread and growing desire to volunteer personal time to gain understanding and to help find answers. Those factors strengthen my optimism that a national back-to-the countryside program will become a reality.

Other Papers in This Series:

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

Via Technology to a New Era in Education, reprinted from the Phi Delta Kappan Journal and drawn from an address at the 1976 Congress of the Society for Applied Learning Technology in Washington, D.C.

A Policy for Export of Products and Technology, from an address given at the Fifteenth Goddard Memorial Symposium of the American Astronautical Society on April 1, 1977 in Washington, D.C.

Technology and Full Employment, from an address to a public hearing of the Minnesota Full Employment Action Council in Minneapolis, Minnesota, on September 6, 1977. On October 28, 1977, Senator Hubert H. Humphrey (D-Minn.) entered the speech in the Congressional Record along with some of his observations.

Harnessing Technology for Better Urban Living, given at the 18th Annual Business Day Luncheon of the School of Business of the University of Minnesota on April 6, 1978, in St. Paul, Minnesota.

Technology for Improving the Image of Business, given at a seminar organized by The Minnesota Project on Corporate Responsibility at The Spring Hill Conference Center, Long Lake, Minnesota, on November 16, 1977.

Technology for The Inner City – Experience and Promise, given to the principals of Chicago United, a consortium of the leading black, white and Latino business leaders of Chicago, on September 1, 1978.

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