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Luther Tweeten

No Great Impact on Rural Areas Expected from Computers and Telecommunications

The high technology of microprocessors, computers, and telecommunications will touch the lives of rural people in countless ways, chiefly as consumer products rather than production items. Microprocessors and microcomputers will help us plan better, inform us, and entertain us, but they will probably affect rural areas less than has the low technology of tractors, fertilizer, and automobiles. Computers will give some rural residents the capability to work at home, corresponding with city offices over telephone lines, and will make some types of policy analysis affordable even for small communities. But computers so far seem to confer no decisive economic advantages to rural areas or cities, nor even to large farms.

Technology's effect on rural areas has been doubled-edged in the past and will probably be so in the future, no matter what form it takes. Technology has allowed less than 3 percent of the U.S. workforce to grow food for America and millions of people in other countries. But at the same time, it has rendered some rural industries obsolete, has forced difficult adjustments on people and areas, and has left some areas with a sparse population and an economic base incapable of supporting a wide range of community services.

In this article, I try to present the likely effects of high technology on rural areas. I have done so by framing the discussion as responses to questions that, based on my observations, seem to capture the uncertainties people feel when confronted by such technological changes. The kind of high technology I am concerned with

is chiefly computers and telecommunications. Another article in this issue of *Rural Development Perspectives* deals with likely effects of biotechnology.

My guess is that computer technology will save much less labor than the tractor does, will raise output far less than fertilizer does, and will have less influence than television and automobiles in reducing the isolation of rural communities. Computer technology seems as much a consumer item as a production item.

Will High Technology Enhance the Comparative Advantage of Rural Areas?

Using data for 1976 and 1980, researchers found high-technology firms generally formed in larger cities that offered plentiful technical skills, a factor that works against rural areas. But the same researchers also found that new businesses generally liked low wages and low taxes, factors that favor rural areas. The same study found that the growth of high-technology firms was not influenced directly by city size but favored low wages, low taxes, and low initial sector share of high-technology employment—all factors favoring rural areas.

The computer industry has divided into two segments, with different geographical foci: (a) research and development (R&D), new products, and administration in California and around Boston; and (b) standardized production in the Southeast (and elsewhere). Rural areas tend to have advantages in standardized production but not in R&D. Many production facilities of high-technology firms have fled older industrial areas in search of cheaper production costs, and found them in areas of low wages, low unionization, low taxes, and less stringent environmental laws.

Because many rural areas possess ample low-wage labor desired by firms for high-technology production facilities, they can be expected to attract such facilities and jobs.

The research and development phase is not labor intensive but is highly capital intensive—human capital intensive. It requires major inputs of scientists, engineers, and skilled technicians. It is likely to be centered more in urban rather than in rural areas.

In a 1985 survey, 1,500 high-technology companies identified what they considered the most important factors in choosing a location for their firm. A favorable environment (clean air and water, low traffic congestion, few community drug/alcohol problems) were rated highly, giving rural areas the edge. Availability of technical personnel, quality medical services and facilities, nearby airport, and consultation opportunities with university people also was rated highly, giving an edge to rural areas close to cities.

Even if rural areas were to share fully in high-technology's R&D, the resulting employment would amount to only a small proportion of the rural labor force. National projections for average annual openings for engineering and science technicians for the 1980's range from 168,000 to 183,000. If rural areas maintain their customary 40-percent share of total U.S. jobs, they would gain about 72,000 of those high-tech jobs, which amounts to well under 1 percent of the total rural workforce.

Estimates from the Bureau of Labor Statistics (BLS) and other studies indicate that from 2-9 percent of total U.S. wage and salary employment in 1980 was in high-technology industries, with such industries defined by several criteria including R&D expenditures relative to sales. High technology, narrowly defined to include highly trained technicians, scientists, and engineers in the computer and telecommunications industries, constitutes a small proportion of all jobs but is growing rapidly. High technology, more broadly defined to include all types of workers in computer and telecommunications industries, constitutes a much higher proportion of all jobs but is growing slowly. Demand for some high technology is mushrooming. But labor productivity is also growing; hence, increased

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sales do not translate into proportional increases in employment.

Based on the above and other considerations, the best judgment is that relatively few jobs in rural areas will be related directly and indirectly to high-technology production. The total number of jobs in high-technology industries will not be very large. Even if rural areas got their full share of high-technology employment and experienced no displacement of labor, the number of new jobs in rural high-technology industries would make only a small dent in the estimated 3 million full-time equivalent new jobs needed for full employment by a rural workforce of approximately 35 million.

In contrast to current service industries in rural areas, which mostly are nonbasic industries serving local markets and hence not drawing outside dollars, advanced telecommunications and computers enhance opportunities for basic service industries in rural areas that serve State, national, or international markets in finance, insurance, and trade. However, basic service industries are likely to settle in choice rural locations with attractive amenities, good schools, and proximity to cities rather than in poor areas where manufacturing and agricultural jobs are being displaced.

Computers probably will replace labor and increase output only to a modest degree over the next decade. They will replace many pencils, notebooks, account books, calculators, and typewriters, and they will provide more precise control of machines and coordination of people. However, for the foreseeable future, they will not replace operators of tractors on the farm, chainsaws in the forest, or draglines in the mine. They will save time and energy but they will not substantially increase the output from resources in rural areas. Electronic cottage industries located in isolated rural areas account for relatively little employment.

Can Computers and Telecommunications Alleviate Some of the Difficulties Facing Local Rural Public Institutions?

Low-cost computer technology has placed sophisticated management techniques in the hands of local rural governments. Most of the extensive volume of software to analyze rural economic prob-

lems was developed at land-grant universities to assist local governments, but some of the programs can also be used by private firms to evaluate alternatives. This software deals with a wide variety of community services as well as with simulating the impact of industrial development, public works projects, or other investments in the public and private sectors. Technical assistance provided by Cooperative Extension Service personnel is widely used and continually improved.

Other innovative uses of computers by local government have been proposed; for example, microcomputer programs to record land use inventories and developments. By using extensive stored information along with appropriate computer soft-

ware, analysts can study land-use impacts at a level of sophistication previously affordable only by large governments and corporations.

Will High Technology Have Much Effect on Rural Areas Through Traditional Rural Industries?

High technology reduces the isolation of rural space to an extent unparalleled since the advent of the automobile and the telephone. Reduced costs of communications enhance the comparative advantage of rural areas, other things being equal. But other things are not equal. High technology in the form of robotics and automation may replace many unskilled jobs in which low-wage rural workers have had a comparative advantage. On the other



Proliferation of rooftop antennas represent the extent of advanced telecommunications that are reducing the effective distance between rural areas and urban centers.

Photo by J. Norman Reid

hand, innovative use of high technology will improve efficiency, helping to keep some manufacturing plants and jobs in rural communities that otherwise might be driven out by foreign competition. The net impact of these forces on rural areas is impossible to judge, but the best guess is that high technology will not be the deciding factor that gives a comparative advantage to rural areas over cities.

Service industries and occupations have traditionally located disproportionately in metropolitan areas, although rural-urban occupational differences have declined over time. Service industries mostly have entailed high costs for human capital, transportation, and communications. Because raw material transport costs tend to be low and service delivery costs high, service industries have tended to locate near their markets.

Advances in the information sector offer some hope for more service-industry jobs in rural areas. Decentralization made possible by microcomputers, fiber optic cables, receiving dishes, and satellites make small businesses and support services possible even at some distance from clients. Rural housewives who find it difficult to work outside their home especially benefit from high-technology cottage industry—using home microcomputers to earn outside income. An independent businesswoman near Sayre, OK, keeps financial accounts, performs management analysis, and makes out income taxes for approximately 20 farmers in her area. It is commonplace for town and city businesses in Oklahoma to rely on housewives to keep accounting records on microcomputers in rural residences.

By sharing services electronically, some rural schools are reducing transportation costs and the need for consolidation. Rural communities that cannot afford teachers to serve small classes of students with specialized needs have benefited from computer-assisted instruction (CAI) and computer-managed instruction (CMI). CAI has been used cost effectively in many sparsely populated rural areas to provide instruction in both basic skills and highly specialized subjects. Despite numerous innovative CAI and CMI efforts in remote rural areas ranging from Alaska to West Virginia, rural schools have generally been slower than urban schools to apply high technology to the classroom.

Will High Technology Give Large Farms a Greater Advantage?

The social and economic structure of rural communities depends partly on the structure of surrounding farms. High technology will give large farms an advantage over small and medium-sized farms, but not so much as to cause major structural changes either on farms or in rural communities.

Computer and telecommunication technologies for business applications are best suited to large farms. A personal computer, with software, costs less than half as much as an automobile and hence is well within the means of most farm families. But the costs for hookup to teletext information systems and for software to manage and operate farms can be steep. In addition, startup time and labor requirements to operate computers can be substantial.

Both part-time small farms and full-time family farms find it difficult to spare family labor time or afford hired labor to operate computers. However, some part-time farm operators may have considerable off-farm discretionary income to purchase microcomputers, may have been exposed to computers in their off-farm work, and may have the multiple-use potential to justify buying a computer.

Computers and telecommunications do not increase farm output directly. They provide information which may make it possible to increase efficiency by using less aggregate input or producing more output. The larger the farm (and hence the more input and output to influence) the more a computer can contribute to efficiency. Large farms have an advantage in being able to afford hired, specialized skills and to spread their costs over many units of output.

Although a higher proportion of large farms than small will use microcomputer and telecommunications technology, and they will use it more intensively in their managing and marketing operations, the advantage to large farms is unlikely to be decisive. Even among large farms, only a minority will utilize microcomputers and telecommunications for planning and analysis. High technology will not save poor managers, profligate spenders, or the unlucky from financial ruin. Personal performance—dedication, initiative, and capacity of operators and their families to

mentally process information and reach sound decisions—will far outweigh high technology in determining the success or failure of a farm, be it large or small.

Farms able to apply high technology at low cost per unit of output will usually have an advantage. But the advantage offered by high technology to large farms at this time is less than that offered by mechanization. The impact of the computer on farm size and numbers will probably be far less than that of the tractor since 1940.

Many of the above considerations also apply to rural communities. Microcomputer and telecommunications technology is affordable by small communities but economies of size in operation continue to favor larger communities. High technology will do much less to reduce the friction and isolation of space than did television and the motor vehicle.

Will High Technology Bring About a More Unequal Distribution of Benefits, Including Income?

It is premature to contend that high technology will give rise to a notably more unequal distribution of income and other benefits. High technology allows society to have more output from given resources. When abundant elements such as silicon, for example, are substituted for labor and are used to generate high-value products, the Nation's standard of living is enhanced. Many of the benefits of high technology accrue to consumers in the form of lower cost, high-quality products. These benefits will be widely shared, approximately in proportion to the consumption of products that are made more cheaply and more accessible by high technology.

More middle-class than other people are involved in producing and consuming high technology. High technology creates large numbers of jobs in marketing, management, and other areas that pay more than routine assembly jobs but less than scientific and engineering jobs.

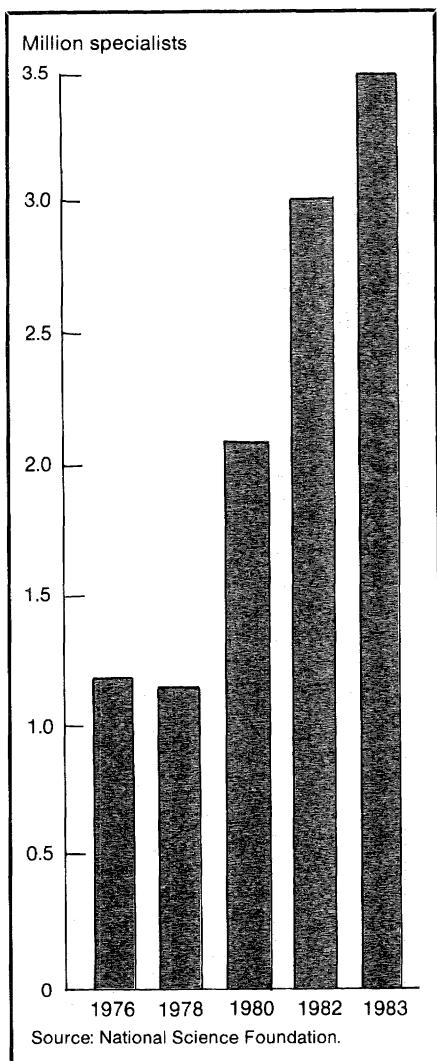
Unlike auto and steel workers in urban areas, relatively few high-paid production workers are expected to be displaced by high technology in rural areas. Rather, production jobs may be created that are likely to be filled by workers improving

their relatively low earnings. Reducing the social cost of space may distribute the employment of scientists, engineers, and skilled technicians more evenly, but much of the high-income, high-technology employment will continue to be in urban areas. However, luck, education, and individual and community initiative will continue to be more important than high technology in influencing income distribution.

Will High Technology Depersonalize Rural Society?

Probably not. Rural areas have long prized such amenities as a friendly, neighborly social atmosphere. The small rural store, church, and bank contribute to this favorable social atmosphere. High tech-

Figure 1
U.S. computer specialists
tripled since 1976



nology has the potential to leapfrog local institutions by electronic "shopping" using video catalogues, by religious broadcasts on television, and by electronic money transfers. But these are unlikely to replace the local store, church, and bank to the extent that the automobile (or mail-order catalogue) has caused these rural institutions to be bypassed. Rural electronic cottages, with people working in their homes while telecommunicating with city offices, offer some promise for economic opportunity in rural areas. While such telecommunication is in itself a poor substitute for personal contact, computer users often form clubs to enjoy social interaction grounded in shared interests. The computer and telecommunication technologies—like motor vehicles, improved roads, radio, television, and rural free mail delivery—will put rural areas more in touch with the rest of the world, and reduce their socioeconomic uniqueness.

Wrap-up

The high technology of computers and telecommunications will improve economic efficiency in rural areas and cities. In agriculture, high technology will improve farm management and marketing but it will increase output far less than does hybrid corn and will save much less labor than does the tractor. And in the industrial sector, high technology will make traditional manufacturing and service industries more efficient, but will have only a moderate impact on production, employment, and income in rural areas.

For some firms, the choice about whether to adopt high technology is narrowed because economic survival requires it. As long as competitors are improving efficiency by adopting high technology, a firm must respond in kind to remain competitive. Use of microcomputers is far more pervasive than can be explained by competition or profit, however. High technology, especially the microcomputer, is a consumption good as well as a factor of production. For many rural and other people and firms, computers will contribute less to value of output than they cost in time and money. This does not necessarily mean the purchase is unwise; it merely means that much of the value of the computer is the pleasure it provides the operator.

To examine only changes in production, communication, or information costs

misses much of the point of high technology. The personal computer is to a large extent a consumption good which people purchase and enjoy much as they would a pleasure boat or a sports car. People will experience high technology more as consumers than as producers. And in production, rural areas will experience high technology more in traditional occupations than in new industry. Rural people will experience the impact of high technology in some form each day in their production and consumption activities, although few will engage directly in producing high-technology items.

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