RURAL AMERICA AND THE INFORMATION REVOLUTION: AN EXPLORATION OF POSSIBILITIES AND POTENTIALITIES

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On the Threshold of the Twenty-first Century

The remarkable improvements sustained by American agriculture over the past century have contributed immeasurably to our national quality of life, to our economic strength at home and our stature in the larger global community. In spite of these singular achievements, however, rural America appears not to have prospered all that much, and the present outlook for the family farm is problematical at best. In 1900, 60 percent of all Americans lived in small towns and rural areas, with more than 40 percent of us actually living on the land, on farms. Today, 25 percent of the U.S. population lives in rural areas and just 1.9 percent on farms proper.

Of course, 25 percent of 250 million Americans is still 62 million people; a large rural nation by any standard. In fact, in absolute numbers, our rural population is greater today than at any time in the nation's history. A more troubling trend is the recent apparent decline in rural prosperity. Median household income in rural areas has fallen or remained stagnant for most of the past twenty years, and poverty in rural areas has risen substantially.

By 1990, rural poverty rates had begun to match U.S. urban levels, with 20 percent of rural households earning incomes at or below the poverty level. The slow growth and faltering prosperity of rural America are noteworthy when compared with the fact that, over the past century, the amount of acreage under cultivation in America has essentially doubled from 25 percent of all U.S. land in 1890 to 51 percent in 1990, and there has been a twentyfold increase in annual agricultural income, from roughly $5 billion in 1890 to $100 billion in 1990.

The conventional explanation for rural decline in the face of burgeoning agricultural productivity has been the "industrialization" of American farming through successive waves of technology. Against a backdrop of rising and falling national economic prosperity and episodic surges in population, the march of technologic progress across rural America has steadily increased agricultural productivity through the replacement of labor by capital-intensive equipment and

supplies. Simultaneously, workers, made redundant on the land over the past century, found economic opportunity in the cities where industrial technology created an endlessly expanding demand for labor.

So long as cities continued to offer attractive employment to surplus rural labor, the process of agricultural industrialization disrupted farm families' lives, but did not serve as a barrier to the steady, generation-to-generation rise in their prosperity. Less fortunate were the generations of small farmers who remained on the land and always depended on non-farm earnings for most of their income. So long as agriculture remained labor intensive, rural America was densely populated with farmers, farm workers and their families who needed a full range of basic goods and services. This marketplace demand, in turn, generated salaried employment to augment the characteristically inadequate small farm income.

Unfortunately, the workers made surplus to the agriculture sector took their incomes with them when they migrated to the city. With the departure of that income, there was less demand for the retail trade and consumer services that once provided supplemental employment for the small farmers and their families. Over time, those farmers who adopted industrial technologies and scale of operations prospered, while small-scale farmers increasingly operated at the margins of the economy and technology, to be wiped out by the hundreds of thousands during periods of economic downturn, such as 1981-1983.

Ultimately, technology changed the fundamental nature of farming in America. Before the Industrial Revolution, the production of food and fiber was the dominant economic activity in the United States and, with the exception of a few bulk commodities, involved mostly small-scale producers competing in local or regional markets. Today, in our mature industrial economy, a combination of production and distribution technologies have afforded America's farmers the advantages of industrial-scale operations and access to massive national and international markets, enabling fewer than 4 percent of all establishments—100,000 farms—to produce more than 50 percent of the gross sales of the entire U.S. agricultural sector.

The concentration of American farming into an ever-shrinking number of larger and larger producing units is an entirely predictable consequence of the industrialization of agriculture. Economists have long understood the propensity of mature mass markets to become oligopolistic. And while farming is not nearly so concentrated as steel making or auto manufacturing, the underlying forces are the same. Economies of scale give the large, well-managed producer so many competitive advantages over smaller producers in most mass markets that, eventually, all small producers are either absorbed or otherwise eliminated from competition. There are no "mom-and-

pop" steel mills, no friendly neighborhood oil refineries in mature, labor-intensive industrial America. A straight line extrapolation of the industrial model upon the U.S. agricultural sector suggests that, eventually, the traditional family farm will simply become unviable in the face of industrial-scale economics.

Basically, America's small family farms have been—and will continue to be—the victims of industrial era productivity-enhancing agricultural technology. In fact, during the past twenty years, agricultural productivity has risen much faster than that of the nonfarm U.S. workplace, so that those displaced by greater efficiency on the land cannot easily find new careers in cities already filled with unemployed industrial workers made redundant by increasingly productive foreign manufacturers. Recently, moreover, the productivity of foreign farmers has even begun to challenge our once seemingly unique capacity to increase the output of America's farms to feed not only ourselves, but much of the rest of the world.

Much of the rest of the world is now using the same technologies that have explosively increased our own agricultural productivity. The "Green Revolu tion," its most powerful weapons first created here in America, has swept across the farmlands of the world, boosting the food production of both developed and developing nations alike. Because of greater national self-sufficiency, the total volume of world bulk crop exports has declined since the mid 1980s, as has the U.S. share of those exports. In response to the twin realities of our own continuing increases in productivity and falling foreign demand, the U.S. has already taken more than 100 million acres of cropland out of production in the past ten years, nearly a 30 percent reduction. Moreover, the conversion of the old Soviet Bloc to free market economics and private land ownership seems likely to make the world's last great grain importer self-sufficient within less than a decade, further reducing global demand for America's surplus output.

Taken together, the parametric trends of the recent past are converging to project a compelling vision of agriculture in Twenty-first Century America, in which 90 percent of commercial agricultural output will be concentrated in the hands of fewer than 50,000 farm firms, franchisees, co-ops, and holding companies. The remainder of our agriculture sector in such a scenario would be made up of one million or so part-time, boutique and "hobby" farmers. Assuming the continuation of agriculture productivity improvements at post-WWII rates, plus shrinking foreign demand and stable domestic markets, another 100 million acres of land are likely to be withdrawn from cultivation in the United States by 2025, with the number of rural residents actually beginning to fall sometime shortly after the year 2000.

If the mass industrialization of our agriculture continues, human habitation will recede from the land, even in areas that are agri-

culturally productive. Farmers, mostly salaried employees by 2025, will live in the still-dwindling numbers of viable rural communities—mostly county seats—or in new communities built around interstate highway junctions and interchanges. Many farmers and farm families displaced from agricultural production in this scenario will remain trapped on the land, unable to find improved economic opportunities in the cities. Characteristically, this is likely to drive rural marriage and fertility rates down to match urban rates. The ultimate evolution of this vision would be a Twenty-first Century rural America in which most farmers will commute out to work at agricultural production sites from towns that will increasingly be scattered like social oases in vast uninhabited "deserts" of high-tech, high-yield farmland.

Happily, past trends alone do not dictate the future, although they *are* powerful forces that instrumentally shape our institutions, our social utilities and our uses of technology. Equally powerful in shaping the future are future trends and developments. Free trade, for example, if adopted worldwide, would almost certainly be a bonanza for U.S. agriculture, opening literally billions of mouths to America's bounty as the superior free market producer of food. Unfortunately, the expansion of free trade is dependent upon political action, which is not reliably forecastable. However, demographics *can* be reliably forecast, and the United States is already the world's third largest domestic market (254 million). With the passage of NAFTA, that will expand to include Mexico's 90 million and Canada's 27 million. That 370 million is projected to grow to more than 550 million people by 2050, as North America—including the United States—is expected to experience the fastest population growth among all of the mature industrial nations.

With projected domestic market growth in the hundreds of millions of people, U.S. agriculture obviously need not fear extinction, nor even, perhaps, acreage reductions. But what about the family farm and rural, small town America? Will these cultural icons of our past survive into our future only as distant memories, rural life farm museums and segments of history disks? Are there future realities that will alter the long-term industrialization of American agriculture? More importantly, are there compelling public interests or reasons for contravening this free-market trend, and are there legitimate policy options for doing so? To consider these questions at all meaningfully, it is necessary to put them in the larger context of the nation as a whole and, in particular, of what is going on in the rest of the world's biggest economic enterprise, the United States of America.

The United States in the 1990s

During the 1980s, U.S. nonfarm employers spent $1 trillion on new production technology, and their productivity did not go up any fast-

er than it did in the 1970s when they spent only $300 billion on productivity-enhancing capital goods. From 1945 through 1965, U.S. productivity—and personal income—increased about 3 percent per year. In the past twenty years, by comparison, productivity and compensation rose an average of .7 percent to .8 percent per year; less than inflation! As a result, real weekly wages for salaried U.S. workers during the same time period have actually fallen nearly 20 percent, from $315 per week in 1972 to only $255 per week in October, 1992. Median household income remained more or less unchanged over the same period, but only because millions of wives and mothers entered the work force to augment their families' declining earnings.

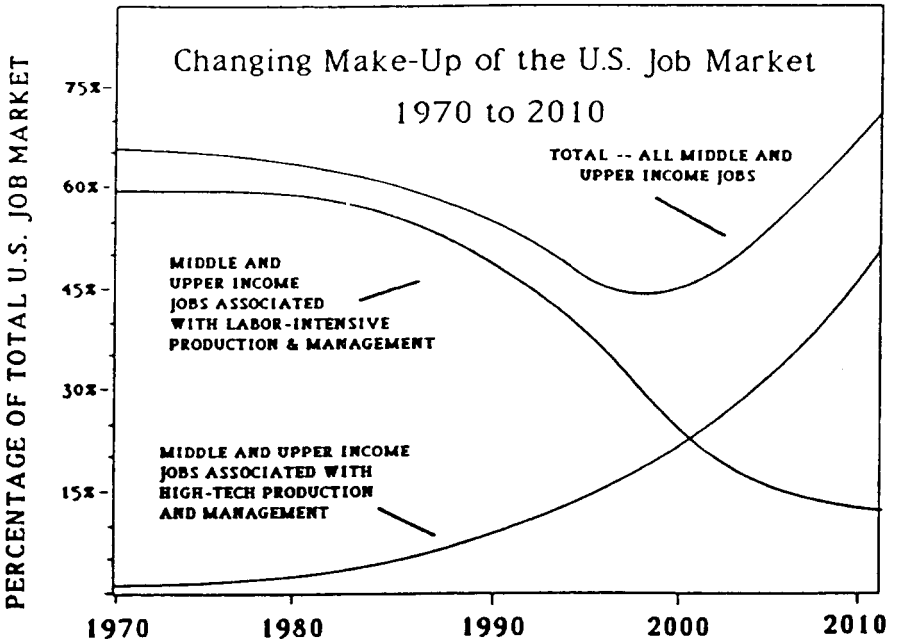
The failure of $1 trillion in new workplace technology to significantly improve U.S. productivity dismayed many observers, including the employers and stockholders who spent the money, and the supply-side economists who had designed the credit policies and tax incentives to encourage the expenditures in the first place. Subsequent economic reviews of the decade, plus research into technology transfer and innovation rates, quickly revealed the source of our failed expectations and the true nature of this moment—*our* moment—in history.

To begin with, it is now clear that America is in the middle of a genuine techno-economic revolution; the sort of transformational event about which historians write entire chapters in textbooks. As with all technological revolutions, the important reality is not the technology itself, but what the technology enables society to do. In the case of our own "moment" in history, computers and their related technologies are enabling us to shift from labor-intensive production to information-intensive production. By increasing the information content of every product and service, plus every operation and job of every productive activity, and then equipping every employee with the skills, resources and authority to make the best-informed plans and decisions, the productivity of every institution and every worker can be hugely increased!

But it will not happen overnight . . . or even in a decade.

It appears to take a generation—forty to fifty years—in order to incorporate the full productive potential of a fundamentally new technologic capability throughout all the levels and all the functions of all the private and public institutions in an entire national economy. It is, after all, a big project. Large systems are inherently stable, made so by the considerable inertia of their multiple internal, inter-connected sub-systems. In a system the size of America, there are literally hundreds of thousands of large sub-systems—corporations, federal, state and local government agencies, schools, hospitals, churches, etc.—each with spheres of interaction, overlapping concerns and both shared and conflicting interests.

Figure 1. Changing Make-Up of U.S. Job Market, 1970-2010.



All of these institutions, in turn, are made up of individual people who must *also* assimilate technologic innovation. And, of course, the technology itself takes time to evolve. The first commercial computers (1953-1954) were fifteen-foot-long electro-mechanical technologies weighing several tons, not at all like the electronic mini-marvels of today. And, while the 586-chip machine (introduced in April, 1993) is five times more powerful than the 486-chip machines (which we have not yet fully mastered), they are only one-fifth as powerful as the 686-chip technology projected to hit the marketplace by 1996 or 1997. Computers clearly have not yet fully evolved.

All around us there is ample evidence that large systems change slowly. But, just as importantly, they *do* change. And, over time, even incrementalism will produce revolutionary change. In the case of America's current "incremental revolution," the data suggest we are nearing the midpoint of our transition from labor-intensive production and management to information-intensive production and management (see Figure 1). The data also show that, during the first half of this forty- to fifty-year transition, the rate at which new, high-value jobs are created lags behind the rate at which existing high-value jobs are eliminated from labor intensive operations. It is this phenomenon more than anything else that has led to the decline in average weekly wages in America, and the commensurate stagnation in family income both in the cities and the countryside.

Clearly, it is in everyone's interest for the nation's employers to accelerate the rate at which they create new, high-value, information-intensive jobs. Fortunately, the experience of the 1980s has shown us how to do this. Even so, revolutionary change is never easy. It involves us all not merely in *one* "paradigm shift," but many "paradigm shifts," changes in institutional cultures, in the collective expectations and in the personal identities of every segment of the American society and economy.

It is, perhaps, comforting to know that the United States will not be passing through this turbulent transformation alone. We will be in the company of the other mature industrial nations of the world. In fact, as the inventors and developers of the new information technologies, we entered this revolutionary period in the early 1970s and began to encounter significant structural job displacement about ten years ago. The other mature industrial nations—notably those in Western Europe and the British Commonwealth and Japan—entered the cycle about ten years later than the United States and have only begun to experience serious structural unemployment in the past two or three years.

In all of the mature industrial economies, the temporary inefficiencies of economic restructuring have had similar effects. Long-term income growth has stagnated, constraining public sector revenues and necessitating reductions in government programs. Millions of jobs have been permanently eliminated, and underlying levels of long-term unemployment have risen. In the United States, unions have commonly accepted substantial reductions in pay and benefits in exchange for continued employment, while German steel and auto workers have accepted four-day work weeks and, in Britain, where miners' unions have refused to make such concessions, the government has simply shut down the coal mines.

The mid-career displacement of hundreds of thousands of middle-class workers has provoked another common phenomenon throughout the industrial world: the rise of right-wing nationalist and racist hate groups and political movements, as those who have lost economic security seek redress by attacks on immigrants and minorities whom they blame for their diminished expectations. Such socio-political turbulence is, of course, characteristic of periods of techno-economic transition, as historic accounts of Britain's original Industrial Revolution make clear. In the early Nineteenth Century, mobs of displaced workers stormed through the streets of Nottingham, Manchester and Leeds, breaking into mills and smashing the power looms whose prodigious output had eliminated their jobs.

Thus, the recent economic stagnation in rural America must be considered in the larger context of the nation's economic restructuring. Current administration proposals to eliminate thirteen of forty-three U.S. Department of Agriculture (USDA) agencies, 1,200 USDA

field offices and 7,500 employees are much more a reflection of system-wide revenue constraints than they are the result of a national sentiment to reduce our commitment to progressive farming. Rising poverty is not a special problem of rural America, but a common problem of *all* America. And the future of U.S. agriculture, like the future of U.S. manufacturing, banking or retailing, will be much more dependent on how U.S. farmers use new technology to add value to their operations than it will on American agriculture's ability to mobilize political support for new farm programs or foreign trade initiatives.

Lessons from the Eighties, Strategies for the Nineties

While the $1 trillion that American employers spent on workplace technology during the 1980s did not increase our productivity, it *did* buy us a lot of valuable experience. In particular, we began to understand the true nature of the information revolution and what must be done to derive improved performance from electronic info-com technology. The lessons of the 1980s, while learned principally in America's factories and offices, are equally relevant to America's farms and rural communities. The universal application of these lessons, in turn, will be essential to the revitalization of all sectors of the U.S. economy and the restoration of our competitiveness and prosperity.

To begin with, it is now clear that, in the Twenty-first Century, we are *all* going to be "information" workers. This does not mean we will all have college degrees, wear tailored clothing and spend most of our time at desks in offices. There will still be millions of blue collar and consumer service jobs in the Twenty-first Century, but all jobs—from the shop floor to the executive suite, from the farm and forge to fast foods and pharmaceuticals—every job will have more information content in it. Moreover, to perform these jobs, it will be necessary for the worker to be able to use information to make important decisions on a daily, hourly and moment-to-moment basis. In the words of Harvard professor Shoshona Zuboff in her prescient book, *The Age of the Smart Machine*, in the 1990s, we are all going to be "informated."

Already, hotels are training their bellmen to conduct structured exit interviews of departing guests. Rental car lot attendants are being equipped with palm-top computers to calculate rental charges, record complaints and print receipts at carside. By the end of the decade, essentially all factory workers will not only be expected to use computers on the line, but to use statistical process control and Pereto analysis, and to work in performance improvement teams made up not only of co-workers, but representatives of suppliers and customers. Retailers are already being provided with ever-more-detailed, real-time information regarding which combinations

of products, promotions and display arrangements produce the highest profits.

Farmers, too, will increasingly be informated. Computerized expert systems will improve crop and animal yields while reducing costs. Electronic networks are providing a growing number of farmers with easy access to the latest agricultural research and moment-to-moment information on future commodity demands and prices. Mounting pressure from ecologists to cleanse farming of all chemicals in order to protect consumers and the environment from agricultural pollution is likely to force more stringent regulations upon farmers, thereby accelerating the growth of organic farming with its considerably more sophisticated information requirements. Producing for global markets—and for more culturally diverse domestic North American markets—can also be expected to substantially increase the diversity of information required by food producers to compete effectively.

Distinctive Enterprise Attributes in the Information Age

By purposefully incorporating more information into all of their planning and decision making, farmers—like those in all other productive enterprises—can improve the marketplace performance of their operations in three specific ways:

Adaptive Enterprise. Under the industrial system of mass production for mass markets, individual enterprises have characteristically concentrated on producing a limited number of outputs for a specific set of buyers or customers year-in, year-out. An interruption either in the supply of raw materials or customer demand generally leaves the industrial-style producer at the mercy of external forces, with no alternate sources of supply or alternative buyer for the organization's products or services.

The "informated" enterprise, by comparison, maintains an up-to-date inventory of alternate suppliers, distributors and buyers. The informed producer also knows the full range of outputs its existing resources may be used to produce. In anticipation of probable changes in its operating environment, the adaptive enterprise "informates" (trains) its employees to be able to perform a variety of tasks, as opposed to the single skills of industrial age workers. In fact, by informing itself about probable changes in economic, technologic and social externalities, the informated enterprise is able to take advantage of changes in its operating environment, creating new products and meeting emerging marketplace demands, even as the rigid, reactive industrial-style producer seeks protection from the effects of external change and longs for the good old days of "business as usual."

Precise Enterprise. As electronic info-com technology continues to rapidly increase the ease and reduce the cost of accessing and applying useful information to all of our decisions, plans and designs, all products and services will be more precisely tailored to the specific needs of individual buyers or users. Human factors engineers, for example, will incorporate ergonomic characteristics into the design of all tools, work stations and production equipment, dramatically increasing general levels of user productivity over the next generation of durable goods. Already, information products, from mass mailings and magazine advertising to insurance policies and credit cards, are being targeted at narrower and narrower specific markets, and manufactured goods are about to follow.

Laser tailors in London and New York are measuring customers and cutting out perfect suits "while you wait." In Japan, retail sales outlets of the National Bicycle Company offer customers a standing model bike that is universally adjustable to each buyer's measurements. Data from the floor model, set to an individual buyer's specifications, are transmitted to the factory which manufactures the custom bike within two weeks for only 10 percent more than a mass-produced bicycle. A growing number of producers of manufactured housing in Japan and the United States design customized homes for clients on computers that produce drawings, specifications and parts lists for rapid assembly. And the Iacocca Institute at Lehigh University, Bethelem, Pennsylvania, has produced a proposal, *21st Century Manufacturing Enterprise Strategy*, that envisions an American auto industry that, within fifteen years, will be able to build and deliver custom-made, defect-free cars within three days of receiving the order from the dealer.

Efficient Enterprise. One important result of the greater preciseness with which informated operations make plans and decisions will be the increasing efficiencies of such operations. In this context, the concept of efficiency includes, but goes considerably beyond, traditional economic notions of the productive uses of capital, labor and raw materials to incorporate the environmental costs of using alternative production processes and resources. Over the next ten years, the "Total Quality" movement and the environmental movement will converge in the informated enterprise to make manifest a fundamental operating principle originally coined by Henry Ford: "If it doesn't add value, it's waste!"

As we get better and better at applying all available information to the design of all of our products and the processes by which we produce and distribute them, we will gradually eliminate the great bulk of scrap material, harmful by-products and residual waste of all enterprise, including agriculture. Our ability to add value by adding information to all of our productive activities, including farming, will

be crucial to sustaining the economic survival and prosperity of those activities.

Transformation to Information-Intensive Farming

In the abstract, the vision of a mature, information-intensive U.S. agricultural sector is enormously appealing. Instead of concentrating almost entirely upon twenty-five to thirty commercial crops for most of their income, America's informated farms would be producing a rich mix of products ranging from food and flowers to fibers, dyes and pharmaceuticals. Researchers in the United States, Great Britain and The Netherlands have already produced therapeutic proteins in the blood and milk of farm animals for substantially lower costs than the same compounds produced in the laboratory. And, around the world, geneticists have announced ongoing breakthroughs in producing vaccines in plants, as well as bio-polymers—natural plastics that will degrade in landfills. Genetic engineering is also improving the efficiency with which the environmentally safe fuel ethanol can be produced from cellulistic bio-mass.

Transgenic research also shows great promise for increasing the value of plant and animal food products, by improving their taste, appearance, texture and preservability. But the outlook for transgenic foods is, at this moment, problematical, due to the legitimate concerns of some portions of the scientific community about the unknown cumulative effects upon humans of consuming large amounts of genetically altered material that does not occur in the natural ecosystem. While this debate is likely to constrain the widespread introduction of transgenic food crops and farm animals in the United States, the use of transgenic farm products as a source of fiber, fuel, chemicals and materials is likely to grow rapidly from now on.

So long as consumer preference and environmentalist pressure continue to foster the growth of organic food production, information-intensive farmers will be better able to keep up with new developments in this rapidly expanding field, as well as with the emergence of new marketplace demands. And, should concern over ecological degradation from chemical intensive, industrial-style farming ultimately lead to the legislature's mandating of organic farming, electronic information networks would be critical to American agriculture's ability to make such a changeover without disastrous reductions in output and concomitant price increases.

Expanded exploration of the world's 250,000 naturally-occurring plant species for potentially desirable commercial characteristics will also be a source of greater diversification in agricultural production as farming becomes more information intensive. The New York Botanical Garden has just signed a $3 million contract with a major pharmaceutical company to search through its collection for medicinally beneficial plants. Similarly, the increasingly rich ethnic mix of

the U.S. population, combined with freer international trade in agricultural products, will offer ever-increasing diversity of marketplace demand for the output of America's farms.

Starting Now: Some Purposeful Policy Interventions

Having made themselves "adaptive, precise and efficient" by their diligent use of information and information technology, U.S. farmers could begin to reverse the effects of mass-market industrialization and restore family farming as a viable basis for long-term prosperity in much of rural America. By adding more information to every aspect of their operations, a large proportion of small farms should be able to identify high-value niche markets for which they can profitably produce. But such a scenario is unlikely to occur without some purposeful interventions in national farm policies and programs. In particular, three interventions would be instrumental to revitalizing family farming and small town America:

1. The Rural Electrification Administration (REA) and its Rural Electric Cooperatives, having satisfactorily accomplished their original mission, should now be redirected to install an information infrastructure—or "info-structure"—for rural America, including electronic information networks, common-use data bases, program libraries and learning systems, etc., linking farmers, extension agents, agricultural research stations, commercial suppliers and buyers with one another. A principal objective of the REA should be to link all of America's farms by fiber optic cable. This new Rural "Computerization" Administration and its Rural "Information" Cooperatives should encourage the acquisition of computers and other electronic information technologies by individual farmers and farm households, through subsidies, bulk purchases and low cost loans. While America's prosperous farms are already moving to informate themselves, most smaller, marginal farms are unlikely to invest in info-com technology without assistance and encouragement.

2. While the Agricultural Extension and Home Extension Services will need to continue pursuing their traditional missions, they must—between now and the end of the Twenty-first Century—give priority to making America's farmers sufficiently "info-competent" that they can make full productive use of computers and the productive knowledge and power tools they make available. During the 1980s, employers learned that, in order to get the full yield out of new workplace technology, it was necessary to spend one dollar on training for every dollar spent on technology. The speed with which potential users learn mastery to apply a new technology is the principal governor of an organization's—or a nation's—overall rate of technology adoption.

If the REA *were* to be given the mission of installing rural America's info-structure, an obvious—and crucial—role for extension would be to assure that all rural Americans—especially those in the agricultural community—are able to use the new technologies to their fullest potential. Given the relatively small number of the total population directly involved in farming—or directly in-putting to farms and directly taking output from farms—it should be possible within ten years to make agriculture the first entire sector of the U.S. economy to be completely equipped and trained to make full productive use of information technology. In addition to substantially reducing USDA's costs to perform many of its various information, educational and regulatory roles, the informating of the nation's agricultural community would set the stage for the de-industrialization of farming, creating a new economic base for rural America.

3. As technology and training improve the capacity of farmers to be "adaptive, precise and efficient," rural economic development programs, policies and practices should increasingly shift toward promoting new agricultural enterprise. Farm-to-market electronic networks should enable farmers throughout the nation to locate and develop niche markets nationwide, just as Nineteenth Century farm-to-market roads enabled farmers to reach regional markets with their products. Given modern transport, burgeoning foreign and domestic markets for specialty produce can be met by farms throughout the U.S. ethnic markets, gourmet markets, restaurant markets, organic markets, industrial and research markets, etc.

   Electronic networks will permit the rapid organization of producer cooperatives and the easy sharing of information among peers which is essential for widespread producer innovations in all forms of commerce. Electronic networks would also make it easy for food processors and packagers to assemble consortia of suppliers for specific ingredients required by new product lines. Individual farms or farm partnerships could process and package pre-prepared foods themselves targeted at specialty markets and advertised over electronic bulletin boards. Farmers who are unusually proficient in particular product lines, or in coaxing high yields out of marginal land, would be able to sell their expertise to colleagues around the world.

Keeping Rural America Rural

Interestingly, there are a number of promising potential nonfarm forces for economic development in rural America today. In about one-half of the nation's 2,000 rural counties today, the population is growing as fast as the national average, or faster! In more than 500

rural counties, population in the 1980s grew at least three times faster than the nation's average, as population has migrated out of nearby cities and suburbs into the countryside. This reversal of the centuries-old urbanization trend has also been noted in Western Europe and, on both sides of the Atlantic, the explanations involve a number of similar factors.

To begin with, as advanced technology and organizational re-engineering have reduced the labor required for manufacturing, fewer factories need to be located near large labor pools, During the first half of the Twentieth Century, individual steel mills typically employed 1,500 to 3,000 workers, with the largest having more than 15,000 employees. Such operations had to draw upon large labor reserves that only cities possessed. But, now that technology has squeezed 85 percent of the labor out of 1950s manufacturing, new steel mills required only 175 to 350 workers, and they are being located in places such as Crawfordsville, Indiana, and Plymouth, Utah, not Cleveland and Pittsburgh. new auto plants—requiring roughly just 1,250 employees—are now popping up in Smyrna, Tennessee, and Normal, Illinois, *not* in Flint or Detroit.

The reason for the urban-industrial out-migration is straightforward enough. Cities are expensive places in which to live and work; land costs are high, labor costs are high, tax rates are high. Confronted by increasing foreign competition from countries with cheap labor, a growing number of U.S. industrial firms have been moving from the cities and suburbs to the countryside, where business operating costs are typically 15 percent to 25 percent lower than in adjacent metropolitan areas. While some economists and demographers believe that the fifteen-year spurt of "greenfielding" high-value manufacturing operations into rural areas is now beginning to decline, others believe that the migration of manufacturers into the countryside will continue unabated, draining economic vitality from the city and bringing it to the land. Policy interventions, such as the creation of "enterprise" and "empowerment" zones by federal and state governments, will clearly have some impact on this aspect of the rural future.

Whether greenfielding remains an important source of future rural growth, other trends seem likely to sustain a rural revitalization. Some states, such as Kentucky, are promoting the availability of their skilled, under-employed rural work force to urban employers via electronic networks. Electronic information technology will permit telecommuting, both by salaried workers and the self-employed. These folks—designers, editors, graphic illustrators, researchers, software writers, consultants, etc.—can live anywhere they choose that the info-structure permits. A large share of this small, but rapidly growing, population is choosing to live in rural areas because of the high quality—and relatively low cost—of living. And these people are bringing their incomes with them.

The twin virtues of low cost and high quality are also drawing another rapidly-growing flow of migrants into rural America—retirees. About 40 percent of retirees who move inter-state when they retire now end up in rural areas, and in those 500 rural counties experiencing the most rapid growth rates over the past twenty years, relocating retirees represented half or more of their growth. Recreational development has also boosted rural economies since the 1970s, often in conjunction with planned retirement communities and "full service" condominium developments. While the popular image of resort developments is that they are set in sites with golden beaches or snow covered ski slopes, a growing percentage are found along midwestern rivers, in the lakes of the Ozarks and among the hills and ponds of northern Michigan.

These in-flows of population and employment have already begun to revitalize large areas of rural America. But, where they have occurred, these developments have necessarily changed the character of rural America. While the U.S. Department of Commerce extols the opportunities offered by "non-urban growth centers"—i.e., prospering rural areas served by regional airports and interstate highways—these new communities are strikingly different from traditional, "small town" America. Modern commercial development "suburbanizes" rural areas, turning them into continuous strip malls of fast food clusters, auto dealerships, retail chain outlets and trailer parks. If rural America is to remain a unique cultural entity, it must retain its low density populations, scattered sparsely across a landscape, of productive and profitable working farms, and not five-acre "farmettes."

This does not mean we should attempt to bar the suburbanization of rural areas. To the contrary, the migration of footloose industries to rural areas—common to all mature industrial nations—is clearly an adoptive phenomenon of the free market that is beneficial to national economies in the aggregate. Similarly, it would be inappropriate to use policy intervention to prevent the withdrawal of agricultural production from marginal farm land, or the draining of population from regions in which the industrialized mass production of commodity crops represents optimum land use.

America's two million square miles of rural land should be managed as the multi-dimensional national asset it is, and not simply shaped to look like a single uniform ideal of what a rural landscape ought to look like. In this respect, the USDA should take its lead from the U.S. Department of the Interior, which has made a commitment to institute a comprehensive plan of "ecosystem management" for all public lands. America's agricultural lands should be regarded as a finite resource of inestimable value. Land that is marginal should be removed from production, renewed and husbanded against a future time when climatalogical changes, ecological disas-

ters or the growth of global population may require that such lands be returned to production.

Similarly, rural land that is suitable for raising a wide variety of high-value agricultural products should be utilized in an environmentally sound manner to meet appropriate marketplace needs by farmers whose mastery of information technology enables them to be "adaptive, precise and efficient" commercial enterprises, rather than captive providers of a handful of bulk products at commodity prices to food processors and packagers who add most of the perceived value and make most of the profits. In summary, just as we are reinventing business, government, education and health care for the post-industrial era, we must also reinvent agriculture for the twenty-first century.