The policy emphasis must shift from saving small hospitals to ensuring excellence in primary care and emergency services. Safe, appropriate, and accessible care is within reach of rural citizens. Primary care and emergency services are the fundamental needs of any community, regardless of size. If the community is too small to support a full-service hospital, it should work to build a solid foundation of primary and emergency care rather than trying to save a facility too small to provide inpatient care in a cost-effective and medically sound manner.

Local leaders should expect some resistance to such changes. For example, political rivalries within and between communities may require that new facilities, if any, be located in a neutral location. Another common probem is that many rural residents are unaware of their local hospitals' ailing financial condition and so see no need to change. They often believe that the government will eventually intervene to save their hospitals. Extensive and sustained public information campaigns are necessary to educate rural residents about the true status of local health care. Last, some physicians, comfortable in the current system, may resist change. Local leaders will probably want to work closely with all physicians, to convince them that there is no other viable alternative, and to encourage them to help make the new system succeed.

We have the science and technology to revolutionize rural health care. Progressive rural hospitals, seeing themselves as ongoing businesses with important missions instead of obsolete buildings, can be in the vanguard. But they must be open to new forms of health care delivery. Improving services, not preserving beds, is a goal to be pursued with pride in many of our country's smaller towns. RDP

For Additional Reading . . .

LaVonne Straub and Norman Walzer (eds.), *Financing Rural Health Care*, New York, Praeger, 1988.

United States Senate, Special Committee on Aging, Senator John Melcher (Chairman), *The Rural Health Challenge*, October 24, 1988.

Stephen M. Smith and David L. Barkley

Contributions of High-Tech Manufacturing to Rural Economies

High-tech firms in nonmetro areas of the West offer better paying jobs than low-tech firms. They also tend to employ more people. Drawbacks: high-tech jobs may not match the skills of local workers. Plus, high-tech plants tend to purchase more of their supplies from outside the local area than low-tech firms. Most high-tech firms still prefer the big city, but some nonmetro counties, especially those on the urban fringe, can also attract them.

National employment projections through the 1990's also show employment in high-tech industries growing by more than twice the rate of manufacturing in general. High-technology manufacturing also can be a viable and attractive source of employment and economic growth for some rural communities. Employment in nonmetro high-tech manufacturing grew by more than 15 percent from 1975 to 1982, with even higher rates in the less populous counties.

Such industries have not generally been sources of economic and employment growth in rural areas. In their formative and early-growth stages, these industries need up-to-date engineering and scientific information, skilled and technical labor, and specialized inputs, all of which are more readily available in urban areas than rural.

Before rural communities or States base major development efforts on these recent trends, however, they need information on the types of rural communities that can expect to attract high-tech manufacturers, characteristics of high-tech establishments likely to locate in rural and smalltown areas, the types of jobs created, the extent to which a high-tech plant stimulates further local economic activity, and whether high-tech manufacturing is any better in these respects than the low-tech manufacturing that rural areas traditionally at-

Stephen Smith is an associate professor in the Department of Agricultural Economics and Rural Sociology, Pennsylvania State University. David Barkley is a professor in the Department of Agricultural Economics, Clemson University.

Figure 1

Location of nonmetro high-tech plants by size and proximity to urban areas

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Figure 1

Location of nonmetro high-tech plants by size and proximity to urban areas

Table 1—Characteristics of surveyed plants

Type of plant	High-tech		Low-tech		Entire sample[1]	
	10 or more employees	Fewer than 10 employees	10 or more employees	Fewer than 10 employees	High tech	Low tech
	Number of plants					
Single unit	101	82	94	124	184	221
Headquarters	24	4	16	9	28	26
Branch	51	7	35	11	62	46
	Average number of employees					
Single unit	36	4.8	28	4.4	22	15
Headquarters	116	5.8	48	5.3	100	33
Branch	145	5.4	139	6.6	128	107

	Majority county ownership		Majority State ownership	
	High-tech	Low-tech	High-tech	Low-tech
	Percent			
Plant ownership				
Single unit	88	88	94	95
Headquarters	75	76	82	88
Branch	11	24	18	48

[1]Row sums may not match due to missing values.

tracted. We address those issues using information gathered in a survey of 927 high- and low-tech nonmetro manufacturing establishments in 11 Western States.

Even Rural High-Tech Firms Want to be Near City Lights

While rural locations for high-tech firms seem to be becoming more attractive, nearly 90 percent of U.S. high-tech employment was located in urban areas in 1982, with 56 percent of the sector's employment in urban centers with populations of more than a million. Still, national trends indicate that high-tech manufacturing decentralized employment between 1975 and 1982. Rural employment in the high-tech sector rose from more than 450,000 to almost 520,000 in that period. Moreover, 13,000 of the new rural high-tech jobs resulted from an urban-to-rural shift in the sector's manufacturing activity. That is, high-tech employment grew more in nonmetro counties than would have been expected, based on national growth rates.

Employment growth in nonmetro high-tech manufacturing was influenced as much by a county's population as its big-city ties. The 21-percent growth rate in small nonmetro counties (urban population less than 20,000) was twice that of large nonmetro counties (urban population more than 20,000), and total high-tech employment growth in the Nation's small counties exceeded that in large counties by almost 20,000. Large nonmetro counties adjacent to metro areas grew by about 9 percent from 1975 to 1982, while small adjacent counties grew by nearly three times that rate, with the latter counties having twice as many new high-tech manufacturing jobs.

The high employment growth rates in smaller counties reflect the small numbers of high-tech jobs there to start with. Most of the employment is concentrated in the most populous counties. Of the 345 nonmetro counties in the West, 119 had no high-tech manufacturing employment in 1982, and only 110 had more than 50 people employed in these industries. Almost 80 percent of the West's rural high-tech employment was located in counties with populations over 25,000. The 140 nonmetro counties with fewer than 10,000 people had only 5 percent of the region's nonmetro high-tech employment.

Our 1986 survey (see box) of nonmetro high- and low-tech plants in the West provides further information on characteristics of communities with high-tech manufacturing. Once a business had chosen a particular county, smaller towns did not appear to be at a major disadvantage as locations for high-tech manufacturing. Over a fifth of the high-tech establishments in the sample was in towns with populations less than 2,500. The percentage is similar for towns of 2,500-10,000 and 10,000-25,000. Towns of 25,000 or more were slightly more favored, with 35 percent of the high-tech plants. At the same time, there was only a slight, and inconsistent, pattern of larger plants preferring larger towns. The smaller towns (fewer than 2,500 people) had a much lower percentage of the largest plants. For other plant sizes, however, differences by size of town were small.

When we consider all plant sizes, we find that counties adjacent to metro counties had a higher percentage of the high-tech plants, 57 percent versus 43 percent. This corroborates findings from national secondary data. There are important differences, however, when the size of plant is considered (fig. 1). Larger high-tech plants were more likely to be located in counties adjacent to a metro county, and high-tech plants in nonadjacent counties were usually smaller.

About the Survey

The information for the study came from a mail survey of 927 high-tech and low-tech manufacturing establishments located in nonmetro counties in the 11 contiguous Western States (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming). The sample was drawn from the manufacturing directory for each State for 1985 or 1985/86. All nonmetro counties in each State were identified, and all high-tech establishments listed in the directories for those counties were selected for the survey. A 10-percent random sample of low-tech establishments was selected from the same counties as the high-tech establishments. The total number of responses was 638, for an overall response rate of 68.8 percent. The usable response rate was 62.7 percent, including 280 high-tech and 301 low-tech establishments.

The result is that high-tech employment was more heavily concentrated in a relatively few nonmetro counties adjacent to metro counties. Half of the high-tech employment in the survey was in the 82 adjacent nonmetro counties, while the remaining half was distributed among the 258 nonadjacent nonmetro counties.

What are These Rural High-Tech Plants Like?

Many rural communities are viable locations for high-tech manufacturing. Getting the plant there is only one issue, however. The plant's characteristics (how many jobs? is it a branch plant with headquarters elsewhere? is it a single-unit operation? who owns it—local people or outsiders?) determine its effects on the local economy.

Branch plants and those owned by outside residents often are not oriented toward the community, and tend to purchase fewer inputs in the local community. Branch and single-unit plants also can provide different employment opportunities. Branch plants tend to be oriented more toward routine production and to employing less skilled, lower paid workers. These plant characteristics imply different local development policies. Locally owned plants are more likely to respond to policies supporting entrepreneurship, or to retention and expansion programs. Branch plants, on the other hand, would be the target of the more traditional development activities that focus on attracting plants from outside the community.

Over 70 percent of the sampled plants were single-units, 19 percent were branches, and less than 10 percent were headquarters (table 1). These percentages are about the same for both high- and low-tech categories. Branches were larger than both the other types of establishments. These differences were slight for small plants (fewer than 10 employees), but for establishments with 10 or more employees, branches averaged 145 employees, single-unit plants 36, and headquarters 116. The smaller plants were primarily single-unit (87 percent). Among the larger plants, branches made up over a quarter of the total.

Our surveyed high-tech plants generated more jobs per plant than the low-tech plants. The average for all high-tech plants was 52 employees, and 32 employees for all low-tech plants. Among plants with 10 or more employees, the high-tech establishments averaged 78 employees versus 57 for the low-tech. The smaller establishments, both high- and low-tech, were virtually the same size, at 4.9 and 4.7 employees. High-tech branch and single-unit plants were slightly larger than low-tech plants, and high-tech headquarters with branches elsewhere were more than twice the size of similar low-tech plants.

Owners of single-unit and headquarters establishments, both high- and low-tech, were overwhelmingly local (more than half of the ownership by residents of the same county or State where the plant is located). That was not true for branch plants, however, as only 1 in 10 high-tech branch plants was owned by county residents and 1 in 5 was owned by State residents. Low-tech branch plants, on the other hand, had much higher levels of same county (24 percent) and same State (48 percent) ownership.

High-Tech Plants Generally Offer Better Jobs than Low-Tech...

The surveyed high-tech plants had larger percentages of employees in the highest skill occupations (professional/technical and skilled production workers) and lower percentages in the lowest skill category (laborers). The differences between high- and low-tech were particularly large among single-unit and headquarters plants. For these plants, the percentage of professionals was twice as high in high-tech plants, and the percentage of laborers less than a third (table 2).

Among branch plants, however, the picture is different. There were no statistically significant differences between high and low tech with regard to the percentage of professional or skilled workers employed. Thus, both high- or low-tech branch plants provide employment opportunities for similar types of workers.

A final key difference is that the types of workers hired by high-tech, single-unit plants were clearly different from the other types of plants. Branch plants and low-tech, single-unit plants were

Table 2—Share of plant employment in selected occupations (10 or more employees)

Occupational category	Branch plants		Single-unit and headquarters plants	
	High tech	Low tech	High tech	Low tech
	Percent			
Professionals	9.3	6.2	15.1	7.9*
Precision production	18.2	16.2	23.0	17.5*
Operators, fabricators	39.8	27.4	28.5	30.8
Laborers	11.5	18.2	6.2	19.6*

* Difference is statistically significant

decidedly more oriented to lower skilled workers, and thus toward more routine production processes. Over half of their workforces were in the operator, fabricator, and laborer occupations, versus less than 35 percent for the single-unit, high-tech plants. Thus, the single-unit, high-tech plants appear to fit the labor force characteristics of high-tech industries in urban areas by employing high percentages of skilled workers and low percentages of low-skill and unskilled workers.

...But Not Necessarily for Women

As job opportunities decline in the male-oriented industries of farming, mining, forestry, and related processing, rural families increasingly rely on the earnings of women. Employment opportunities for women in growing industries will contribute significantly to alleviating economic stress on rural families and communities.

In the establishments studied, high-tech plants employed a slightly higher percentage of women than did low-tech plants, 31 versus 28 percent. Among plants with 10 or more employees, the difference widened to 33 versus 26 percent, a statistically significant difference. Branch plants accounted for most of the difference. For both the sample as a whole and plants with 10 or more employees, high-tech branch plants employed significantly higher percentages of women than low-tech branches (30 vs. 23 percent, and 32 vs. 21 percent, respectively). The larger, single-unit, high-tech plants also employed higher percentages of women (33 percent) than did low-tech, single-unit plants (27 percent).

While high-tech manufacturers employed higher percentages of women overall, they did so only in the lower skilled production and laborer occupations (fig. 2). In the professional occupations, the percentage of women was much higher in low-tech plants. In the higher skilled precision production occupations, high-tech and low-tech plants employed similar percentages of women. These differences also hold for each type of establishment (headquarters, branch, and single unit).

Thus, while high-tech plants employed a higher percentage of women overall, the female employees were concentrated in branch plants and in the lower skilled production occupations. Low-tech plants, on the other hand, provided considerably higher percentages of jobs for women in the professional/technical occupations.

Figure 2

Percentage of female employees by occupation

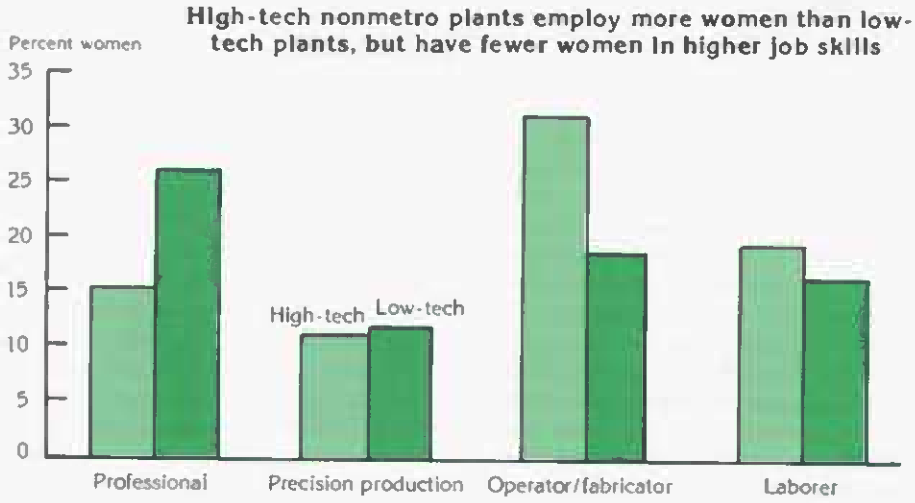
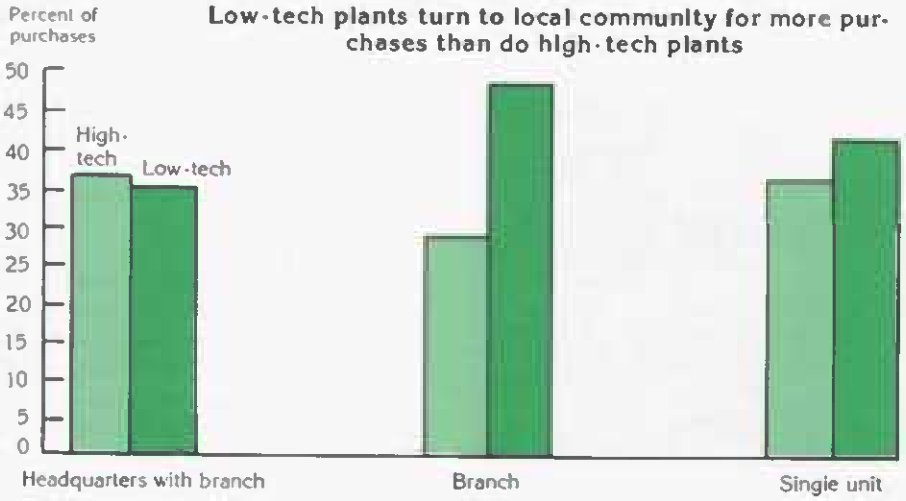


Figure 3

Nonlabor purchases, by plant, made in host county



High-Tech Plants Give Less Business to Other Local Firms

Many industries in the high-tech sector require highly sophisticated material and service inputs, which are primarily available in or near metro areas. The increasing geographical dispersion of high-tech manufacturing, however, may mean that proximity to specialized inputs is not necessary. Even in metro areas, high-tech industries purchase many nonlocal inputs. The implication for rural areas is that high-tech manufacturing may generate relatively few local linkages.

The results of our survey confirmed this for the West. High-tech establishments purchased only about a third of their nonlabor inputs in the county of the plant's location. This was a significantly lower percentage of local input purchases than low-tech establishments made (42 percent). The difference was most pronounced among branch plants, with low-tech branches purchasing almost half of their nonlabor inputs locally versus less than 28 percent for high-tech branches (fig. 3). Among single-unit plants, low-tech purchases in the county also were greater than high-tech purchases (41 versus 36 percent),

but there was no difference among headquarters establishments. Input purchases within the State were higher for all plants, but the gap favoring low-tech plants widened to 58 versus 70 percent.

Other factors besides technology and establishment type influenced the percentage of locally purchased inputs. One was local ownership. Locally owned plants, whether high or low-tech, purchased larger percentages of local inputs. Also, plants in counties adjacent to metro areas made fewer local purchases, although location in a larger town or county tended to counter this influence. Nevertheless, even after we accounted for other factors, high-tech plants, particularly branch plants and larger plants, still purchased lower percentages of local nonlabor inputs.

Implications for Rural Communities

Despite indications that high-tech industries are a viable source of employment for rural areas, nonmetro communities should not totally concentrate their industrial inducement efforts on this sector. High-tech industries constitute less than 25 percent of the Nation's employment in manufacturing and business services, and the amount of rural high-tech employment is only a small fraction of this. Thus, the competition for new plants or relocations will be intense.

Nevertheless, the research summarized here is generally positive about the contribution of high-tech manufacturing to rural economies. Our data show that both small towns and counties not adjacent to metro areas were locations for high-tech plants, although larger towns and counties adjacent to metro areas were favored. Also, the high-tech plants averaged more employees per plant than the low-tech plants.

The type of plant will influence both development policy and impacts. External recruitment efforts are geared to attracting branch plants or relocating plants. If a branch plant of a high-tech firm is the target or most likely opportunity, the resulting employment effects will be similar to those of branch plants in any industry. Different jobs, particularly professional and skilled production jobs, generally will not be provided. While this may not meet goals of upgrading the local workforce, the match with local labor skills may be better. The jobs being lost, and thus needed, in most nonmetro communities are not highly skilled or technical. Also, job opportunities for women are relatively good in the low-skilled production occupations in the high-tech industries, but not in the professional job categories.

Three-fourths of the rural high-tech establishments were *not* branch plants, however. The single-unit and headquarters establishments provided significantly higher percentages of professional, technical, and skilled production jobs than branch plants. These firms were more than just routine assembly operations. And although they provided fewer total jobs per plant than branches, smaller communities can more easily absorb smaller businesses. Furthermore, since these plants were primarily locally owned, business conditions in the community may be important to their success. Programs such as retention and expansion or entrepreneurial assistance may be influential. In many cases, such efforts are likely to be more efficient uses of a community's or State's scarce development resources than recruitment.

High-tech manufacturers, especially branch plants, purchased much lower levels of nonlabor inputs locally than did low-tech plants. Communities that become hosts to high-tech manufacturing will benefit from the direct employment, but much less from backward linkages than with low-tech industries.

What is High-Technology Manufacturing?

Most analysts have their own definition of high-tech industries. This study selected the definition developed by Armington, Harris, and Odle of the Brookings Institution. Their study classified an industry as high-tech if: (1) more than 8 percent of the employees were in scientific, engineering, and technical occupations, and at least 5 percent of industry employment was in the more narrow class of scientific and engineering occupations; or (2) expenditures for research and development relative to product sales exceeded the national average. The following 24 manufacturing industries (three-digit SIC) were identified as high-tech using the above criteria.

Standard industrial code	Industry	Standard industrial code	Industry
281	Industrial inorganic chemicals	365	Radio and TV receiving equipment
282	Plastic materials, synthetics	366	Communication equipment
283	Drugs	367	Electronic components, accessories
286	Industrial organic chemicals	372	Aircraft and parts
289	Miscellaneous chemical products	376	Guided missiles, space vehicles
291	Petroleum refining	381	Engineering, scientific instruments
348	Ordnance and accessories, n.e.c.	382	Measuring and control devices
351	Engines and turbines	383	Optical instruments and lenses
353	Construction and related machinery	384	Medical instruments and supplies
356	General industrial machinery	385	Ophthalmic goods
358	Office and computing machines	386	Photographic equipment and supplies
362	Electrical industrial apparatus	387	Watches and clocks

Photo © by Barry M. Riggs

Branch plant of James River Corp. in Chambersburg, PA.

Thus, attracting the high-tech plant may be easier than attracting its business, and communities will have to put special effort into taking advantage of linkage effects.

In conclusion, high-tech manufacturers do locate in rural areas and can contribute to economic and job development goals. The specific contributions of these firms to the local economy, however, will vary depending on whether the establishment is a branch or unit plant. Community development leaders need to consider these differences when designing industrialization programs. Finally, the results of this study should not be generalized beyond the nonmetro West. Conditions in other regions, such as industrial structures, population densities, and distances, may lead to different influences on or different impacts for high-tech manufacturing. RDP

For Additional Reading...

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Mark G. Popovich and Terry F. Buss

Entrepreneurs Find Niche Even in Rural Economies

New businesses begun in North Dakota since 1980 employ nearly a fourth of the State's workforce. That ratio is about the same in urban and rural areas alike, even in areas highly dependent on farming. The new businesses seem to be durable, with a survival rate of nearly two-thirds through 1987. About half of the new business ventures turned to their local banks for startup financing, but few looked to government programs for help.

Throughout the 1980's, America's midsection contended with successive economic shocks that squeezed the economies of many rural communities. North Dakota was not exempt from the pinch of deteriorating agricultural markets and a declining energy sector.

But even during the hard times of the 1980's, entrepreneurs created thousands of new businesses and jobs in North Dakota, in rural areas and cities alike. Between 1980 and mid-1987, just under 7,800 new businesses, including 4,600 in nonmetro areas, were successfully launched across the State. These new businesses generated 42,000 jobs (22,000 nonmetro), representing just less than a quarter of the State's total private sector employment (specifically, those covered by unemployment insurance).

Based on a survey we conducted last summer and other data, we tried to measure the scope and impact of entrepreneurship in North Dakota, focusing on the State's rural areas. Our conclusions contradict some common assumptions about the impact and durability of new businesses and the role of local banks in financing new starts in rural communities.

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Figure 1

Employment impact of successful new businesses

(New business employment as a percentage of total private sector employment covered by unemployment insurance)