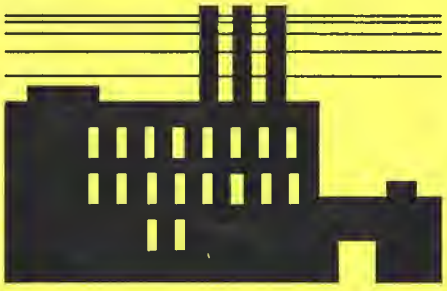
Southern Growth Policies Board

REVIVING THE RURAL FACTORY



Automation and Work in the South

Volume 2: The Case Studies *May 1988*

By
Stuart A. Rosenfeld
Emil E. Malizia
Marybeth Dugan

The Southern Technology Council
of The Southern Growth Policies Board

PO Box 12293
Research Triangle Park
North Carolina 27709

Southern Technology Council

The Southern Technology Council is a newly formed, public/private advisory body to the Southern Growth Policies Board. Chartered in 1986 to enhance the development of technology within the region, the Council seeks to provide a regional forum for sharing ideas and strategies; to study the internationalization of technology and suggest state and federal policies; inform and educate state legislatures, government agencies, and the public regarding the importance, value, and effects of new technology; and facilitate the transfer of ideas to the marketplace by bringing together innovators with venture capitalists and business people.

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Stuart A. Rosenfeld
Project Director
May 25, 1988

CASE STUDY I

FROM TEXTILES AND TRADITION TO COMPUTERS AND CAD/CAM: *AUTODRIVE, INC.*[1]

by Joan Oleck

Introduction

Inside the mammoth manufacturing facility of Autodrive Inc. in Dooley County, machines are humming, machines are turning, machines are moving. It's the people that, in comparison, seem still.

At Autodrive, a manufacturing workforce of more than 600 yearly turns out 60,000 to 80,000 axles and 10,000 transmissions for use in off-highway construction, forestry and mining machines. Here, in the 400,000-square-foot windowless factory, signs of that industry are everywhere: the smell of oil fills the air. Conveyor belts, hoses and drums, and barrels of sparkling cast iron chips create an industrial maze. Blue, green, and orange machines packed side by side create a constant din.

Yet, aside from a few blue-jeaned workers zooming around on forklift trucks, most employees seem almost motionless. Staring intently at computer screens, they move mainly their hands to fine-tune controls.

Autodrive has entered the age of automation. And workers interviewed seem generally pleased at no longer having to strain their bodies to shuffle heavy drills and cutting tools between machines. "You either use your brain or your brawn," says an employee of some 27 years. "I think I'd rather use my brain." This particular day, he is running a Cincinnati Milicron 15-CU computer numerically-controlled (CNC) turning work center which transforms barrel-like hunks of iron into precisely-shaped wheel hubs. The 15-CU replaces a conventional manual lathe, with pre-set tooling and stops. Just down the aisle is something even fancier: a T-30 horizontal machining center, which replaces separate machines for milling, tapping, boring, and drilling metal. "It can do anything from making Tonka toys to submarine parts," says a unit manager in cast iron machinery.

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[1] All names in this chapter have been changed to conceal the identity of the company.

The T-130 also replaces about 144 tools, eliminating the time consuming set-up and tear-down delays of former days.

Autodrive's four T-130 machining centers, in use for the past year, have replaced about 100 stand-alone machines. The facility now has about 125 CNC or slightly less sophisticated NC (numerically controlled, or driven by punch tapes instead of a computer) machines. Automation has become a vital factor not only in machining but in material handling and automatic inspection. But automation is still something new, says Sam Harris, the vice president of manufacturing for Autodrive Inc., USA, and manager here at the plant in Dooley County. "We are in no way an 'automated' plant. You've gotta stretch your imagination....But down the road, each year we will put $4 to $5 million into the plant."

Autodrive--unusual in the state when it arrived in 1975 for making its own parts as well as the finished product--is so far about 20 percent automated. "We want to be 60 to 70 percent (automated) in eight years," Harris says. "One of our philosophies is we want to do a little bit at a time." The introduction of a robot is an example of this phase-in philosophy, he says. "I'm planning on bringing a robot in early next year, probably in our heat treatment area. But not to replace anybody's job, not to do anything special at this point. But just so people understand what it is...People have got to understand what a robot is before they can get to that mentality."

"People"--or more accurately, policy makers--must understand what automation is in order to implement complementary employment training and appropriate industrial recruitment strategies. That is the purpose of this case study of Autodrive Inc. , to be integrated in the Southern Technology Council of the Southern Growth Policies Board larger project on "The Impacts and Influences of Automation on Manufacturing in the Rural South." Its intention is to find policies and programs to help modernize the South's manufacturing base by alerting policy makers to needs expressed by firms in the process of automation and by their surrounding communities.

The present study of one company, Autodrive, Inc. -- its decision to locate in Dooley County, its training needs, and its impact on the community -- is just one story among many in a world of increasing factory automation.

Portrait of a Community

Roaming buffalo, angry Chippewas and Cherokees and a man betrayed by love are all elements of Dooley County's rich historic heritage. Settled by Anglo-Saxon farmers in the mid-eighteenth century, these gently rolling hills saw the horrors of battle as early as the 1750s French and Indian War. The site of a fort built to protect the settlers still symbolizes the part Dooley played in the French-English conflict.

In the late nineteenth century, pressured by a growing European population, Dooley County was officially formed, carved out from a western county A settlement called Bitter Creek was appointed county seat, and the story around these parts is that people just started calling the town Southfield. The name stuck.

In 1829 Southfield became home to an academy, later to become a community college, and in 1863 the community earned a place on the map when the railroad came through. But townsfolk were barely finished celebrating their hometown's new status when the rails were torn up for wartime need.

Today, agriculture remains the number one industry in Dooley County, which is among the state leaders in hatching egg and cheese production. Cattle and hogs also are big commodities, along with large corn crops, tobacco, soybeans, and wheat.

Yet this county of about 80,000 population is also an industrial county, having attracted a major furniture company as early as 1919, and a number of textile firms in the 1940s and 1950s. A diversified mix of new furniture, textiles, metal-working, and assembly firms followed.

Sources cite three reasons for the many industrial recruits. One is location. Southfield is located at the junction of two major interstates. A large metropolitan center, with banking and cultural centers and an airport, is also close by. And a nearby lake is a powerful recreational draw. "What you've got is an exciting area of the Southeast that continues to draw the big boys," says the state's regional development representative, based just south of Southfield. "I'm talking about not just industry, but investor groups and developers and headquarters for service groups."

The second attraction is the hard-working, family-oriented tradition of the area. The chief of labor resources for the State Department of Commerce, says "When you're

talking about Dooley County, you are talking and thinking about the heart of manufacturing, the soul of manufacturing. What does this mean?" He answers his own question, "You've got people born and raised there, their daddies were born and raised to punch a time clock. I'm talking about the mores of a people."

The economic development manager for Dooley County, Jim Corona, counters that area workers are coming "off the farm," and that that is their strength: they are not afraid of either hard work or machinery. "Probably fifty percent of all the workers in the factories doing automated jobs...have at one time or another worked on farms, torn down the threshers and put them back together, torn down the tractors and rebuilt them...So they're very trainable people, adaptable to equipment." He adds this profile of a"typical" Dooley County workers. "The traditional family that works in a plant has had a tobacco farm or a cotton farm or a cattle farm or a hog farm, and they still do it. The son works it, or the brother-in-law comes over and works it, and at harvest time they all pitch in. The wife probably works in [an apparel] mill, she may be a sewing machine operator on piecework. She and her husband may try to get third shift or second shift together. They have about two-and-a-half kids.

"I would guess they're bound and determined that their kids are going to be doctors or attorneys, and a lot of that's accomplished now. As a group they're intelligent, and I have to go back to the Civil War: they're damned individualistic, they almost whipped the North, and they were outnumbered three-to-one, and in economic means were outnumbered 20-to-one. But, boy, you put one Confederate in the battlefield against three Yankees who had to go by what the general and the sergeant told them, and he'd shoot out two between the eyes."

Though individualistic and determined to give their children a better life, Dooley workers may not be as drawn to management jobs as others Corona has seen. The native Ohioan explains that the high priority placed on religious life here may play a role in the comfort people feel with what is, not what may be. "We're the Bible Belt," Corona explains. "An awful lot of people, if you want to work them on Sunday, they will not work, and you have a helluva time with that...Now, I've just had some foremen say, 'We will not work. We've missed church two Sundays in a row and we don't care if you fire us; we're going to church.'"

In Dooley County, the presence of well over 100 churches, half of them Baptist, supports Corona's statement about the importance of religion. Other demographic factors

culled from federal census and state economic development data, show that of the county's 80,000 population, four-fifths are white, and one-sixth are black--slightly less than the state average. Migration patterns are also below the state figures, with ten percent of the population moving here from within the state and six percent moving here from elsewhere in the decade before the census.

Again trailing state averages are the county's crime rate and the percentage change in housing units. Political leanings are solidly Democratic. And 12 years of schooling is the county's mean in education, slightly less than the state figure. Further, about nine percent of Dooley residents hold a college degree or better, and that again is lower than the percent of highly educated citizens statewide.

In the economic realm, Dooley is ahead of the state. Eight percent of Dooley families are below poverty level, versus 11.6 percent statewide. And the related, low unemployment rate for the county was just over four percent as of June 1987, which is below the statewide unemployment rate for the same period. Dooley income figures also are ahead of the state, showing a median family income in 1981 of $17,500, higher than the statewide average .

Dooley is very much a manufacturing county in terms of where its civilian labor force works. Fully 34 percent work in manufacturing. Besides this manufacturing base, the county--like the entire state --can offer industrial prospects state-paid New Industry Training, through Southfield's Community College.

It also can offer the area's rock-bottom rate of union activity, the third attraction. A Greater Southfield Chamber of Commerce publication lists the total number of unionized employees at two percent. The Chamber of Commerce president lists "union operations" among the area's non-desirables in industrial recruiting, along with firms that pollute or deal in low level radioactive or hazardous waste materials.

"There are areas where unions are welcome," says Tom Allen, the area's regional economic development representative. He mentions the non-manufacturing transportation, communications, and supply firms in the metropolitan area, and implies that unions are not welcome in manufacturing. "We don't take any industrial client into any area without telling the local people about it," Allen says. "If they are union, they (the local people) have the option of saying 'no, we don't want to see them.'"

With all these attractions, then, to offer--hard working people, good quality of life, excellent location, and lack of unionization, it's no wonder that metal-working firms, leaders in automated manufacturing, are coming to Dooley County in general and Southfield in particular. Corona, the county economic development manager, ticks off an impressive list of metal-working firms that have come to town in the last ten to fifteen years, a steel firm located in Southfield since the 1920s, Southern Assembly, here since 1948, and of course Autodrive, Inc. Added also are a dozen or so small machine shops and other support service firms drawn to Southfield in the wake of the larger firms.

But all of the new firms, with the exception of one, have located in the northern part of Dooley County. The question is, why?

South Dooley vs. North Dooley: The Old vs. the New

In 1982 the nearby city of Orlon was stunned: a major textile plant was closing, taking 400 jobs with it. But plant closings in this part of the world had become commonplace: in a neighboring county during the 1974-75 recession fully 22 plants closed, and 18 of them were over 100,000 square feet in size with 200 to 800 workers apiece. Dooley County's unemployment during that recession era soared to 10 percent. "Each of those [plant closings] was textile-related," the industrial recruiter recalls. But he recalls the good news, too: "In every instance we sold or leased those buildings to other types of industry that are not affected by seasonal adjustments or foreign competition."

That's the beauty of Allen's nine-county region. "This is such an active area that normally jobs are picked up pretty quickly. Rarely do you see double-digit unemployment, except during 1974-75," he says. But, he adds, the diversified industry seemed mostly to settle in the northern part of the county, in Southfield and a neighboring county that long had been strongholds for furniture and paper. Textiles, in contrast, clustered in the south. "Roads have a lot to do with the types of industry you have," Allen explains. "When you have a predominately rural atmosphere (as in southern Dooley), that's where the textile industry seemed to go in years past."

Though the number of manufacturing jobs in Dooley County stayed almost stagnant at 16,900 from 1980 to 1985 (while non-manufacturing jobs leaped by 17 percent), the manufacturing job growth that did occur followed this old-new division. Between 1980 and 1985 in Dooley County, according to Employment Security Commission figures, job growth occurred in the following industrial classifications: lumber and wood products (38

percent); paper and allied products (51 percent); and rubber and miscellaneous plastic products (24 percent). A loss of jobs occurred in textiles (32 percent) and furniture (38 percent). Fabricated metals--Autodrive's industry classification--recorded a 27 percent decrease in employment due to several small plant closings during the five-year period.

Overall, metal-working firms seem to have a future in the Southfield region. A large number of the firms came to Dooley and neighboring counties to serve the transportation industry. "This is sort of a truck and bus automotive center of the state," Allen explains. "There again you are able to attract those types of people to the area because of livability: technical people, engineers, designers." These are people who can make hefty demands in terms of what they want from a community.

Allen's region seems to keep satisfying the demands. Under "Transportation Equipment," the state's manufacturing product guide lists 90 firms or divisions that produce motor vehicles or passenger car bodies, truck and bus bodies, and motor vehicle parts and accessories. Of these, 27 are located in the region. Among them is Autodrive, Inc., which straddles the town boudary with the junction of two interstates located smack dab at the edge of its sweeping lawn.

Southfield: An Economy in Flux

Southfield, a community of 11 square miles expanse and about 20,000 population, still hosts traditional industries: a dozen and a half textile firms and about the same number of furniture firms. But 40 metal-working firms show that the manufacturing base is in flux. And, it is in healthy flux: the city has no fewer than 100 firms altogether. Two of these, Autodrive, Inc. and Fast Systems, are among the four largest employers around, with 500 to 1,000 workers each.

Because Southfield's job growth--like Dooley's overall--is in the newer industries, local officials greet their manufacturing newcomers with open arms. The result, says the local newspaper editor, is that "We are real diversified in Southfield. Any one particular company or business does not hit us that hard economically. We are in basically the same situation as we were before the textile jobs cut--that hurt us in the southern end of the county because Orlon is basically textiles.

What is clear, says the general manager of the newspaper, is that Southfield keeps making up for its losses by remaining diversified. The editor can speak from experience of the alternative: he used to work nearby where the newspaper was the third biggest

employer. "Everything else in that town was service stations and mom and pop stores...If the mills had a slump, the town went pffff," he says.

Accordingly, as a result of this diversification, Southfield can afford to be choosy about industry it does bring in. Industry in return gets all the attractions already described, as well as a liveable, small-town atmosphere with tree-lined streets and handsome Victorian homes, an annual Balloon Rally, a Magnolia Festival, and a wealth of cultural and recreational opportunities within a short drive.

State legislation this past session also paved the way for a city/county schools merger. And city residents voted in liquor by the drink in 1986. Further, federal seed money from a Main Street revitalization grant has renovated, Southfield's downtown, adding 40 new businesses and 130 new jobs.

Amid all this change, all this modernization, is a plethora of job advertising the likes of which the newspaper's editors have never seen before. Low-paying service jobs of course abound. But more and more, says Allen, "Our major problem is in the metal-working field...Tool and die makers are almost non-existent except in [the large cities]. Skills that take a long time to train, those are the ones we don't have."

Another change is also afoot in Southfield, Allen says. A change that means weaving machines at the local textile plant have gone from 40 picks per minute to 600 picks per minute. A change that means clean conditions, higher wages and a demand for intensive skills.

The change, Allen says, is automation.

Autodrive Inc.

"Autodrive has had a very volatile history here," one state official says. "They've opened plants and closed plants. One would think that they almost don't know what they're doing." Autodrive officials might respond that they're only trying to survive.

The vice president of worldwide marketing for Autodrive, Inc, explains: "In the last four to five years, since the last significant recession that the industry felt, there were influences created by the strong dollar that made doing business in the U.S. attractive" to foreigners. "So, if a Komatsu (Japanese competitor) truck is sold carrying axles and

transmissions to a (U.S. construction) company that might have bought our axles and transmissions, we don't get to sell it."

Kenneth Moore, editor of *Metal-Working News*, a New York- based trade publication, confirms the problem of components competition with Japan. Sales have increased since the dollar adjustment, he says, but Korea and Taiwan are making increased market inroads. "I would imagine that a lot of those (axle and transmission) customers have gone to offshore manufacturers to get those components," Moore says.

Indeed, Autodrive Inc. itself has gone offshore, opening plants in western Europe and in South America. Of four manufacturing facilities once in the United States, only the one in Southfield remains. And that consolidation move seems predicated on avoiding further losses, which have plagued the firm in recent years.

Autodrive Inc. is described in its parent company's annual report as contributing 30 percent of Autodrive Inc. Worldwide's yearly sales. The 1986 sales were slightly below 1985 levels and were hurt by "continued softening in the North American construction machinery market," the report says. Recovery from the mid-1970s recession continues.

"From 1975 to 1977 we went from rapid growth to rapid contraction," says the vice president of human resources. One result was the 1981-82 closure of two plants in the Midwest and the consolidation of their functions and employee roster into two southern plants. The offshore operations already were in place. Stateside, the consolidation went a step further.

In 1986 one southern plant closed. The closing meant layoffs for more than 500 workers. It also resulted in a complete changeover for the "process" plant at Southfield. The Southfield plant absorbed the sister plant's machinery assembly and manufacture and axles and transmissions functions. The Southfield plant, which had employed 500 prior to 1981, took on an extra 100 people, including about 20 from the other state site. Some 125 workers from the Midwest also moved to Southfield.

"Autodrive Inc USA," with manufacturing operations in Southfield and headquarters still in the Midwest, had $140 million in sales last year. The firm expects to maintain its present workforce level of 630 shop and manufacturing employees and 177 clerical, engineering, financial, and administrative employees.

Can Autodrive reassure its Southfield workers that their jobs won't move offshore, too? "I don't think we can," answers Harris. "Autodrive is committed (to the idea) that we will have a manufacturing and sales base on all continents. We feel that is the only way we can be competitive -- to have both manufacturing and sales...(but) the strongest market is still the U.S. We're dedicated to staying in North America but we also understand that we've got to be competitive.

A friendly, mustachioed man, Harris, describes himself as having "come up through the ranks." Starting in machine shop and assembly work in the 1960s he came to Autodrive as a product designer before going into company administrative jobs in Europe. In 1987, Harris says, the international pressure generated by the strong dollar is off. "In the past two years with the dollar situation where it is, the American construction machinery business is very strong. Not only are they competitive in the U.S. but they're competitive worldwide."

The Southfield Decision: A City/Company Love Affair

The lunch crowd has settled in at the local restaurant just up the higway from the service road into Autodrive. Three Quality Control technicians at Autodrive are polishing off their midday meal under wagon wheel chandeliers, and they are talking about then and now -- the textile era versus the automated one. They like now a lot more than then.

"Let's face it," says one worker in statistical control. "Textile workers are a commodity. If you don't do the job, you're out tomorrow. Here, they put training into the employee. Textiles -- they really weren't too damn interested in the workers' suggestions, they didn't want to know their ideas. They just wanted their eight hours' worth."

A customer service staffer, agrees. "I think management here is more lenient towards workers," he says. "When it comes to discipline you don't get as many chances to make a mistake working for the textile mills as for Autodrive."

Their companion,who has more direct textile experience -- he formerly worked at J.P. Stevens -- prefers to remain anonymous because he's a temporary contractor at Autodrive. His comment about then versus now is evocative of a disappearing era, when textiles were more dominant and less automated than today.

"You didn't have the job security in textiles," he says. "In textiles you had to wear earplugs, and there was lint flying everywhere."

Autodrive's workplace in contrast is clean, loud -- but not painfully so -- and reflective of the new high-tech attitude that employees are colleagues, not expendable material. "There's a difference in management technique," one of the men says of Autodrive. In textiles, he says, "there's very much a class difference between management and workers. Here, we don't have any time clocks."

Not only are all employees at Autodrive paid a straight salary, but the mood is easygoing. In the 40,000-square foot administrative office building fronting the factory and looking out through huge glass windows onto acres of manicured lawns, engineers and accountants go tieless; first names are standard. And employee input at monthly departmental meetings is solicited.

Worker pride also is encouraged, judging from the trophies for the company softball team in the company lobby, and the date painted in red, white and blue on the company driveway honoring a company "declaration" of gratitude to liberty displayed in the lobby and covered with employee signatures.

Under these working conditions, it is easy to see why several union pushes at Autodrive have gone nowhere. If employees have any complaint, it's the constant overtime. Workers say they sometimes labor on the job 12 hours a day -- and some work six or seven days a week. According to the luncheon trio, employees may refuse overtime but company managers at times take a dim view of those who do. In response to the complaints over long hours, Autodrive is implementing 12-hour shifts spread over four days in some departments, to allow fuller machine utilization and reduce overtime, while giving employees a longer rest.

Despite the investments the future still concerns people. "The one thing that worries people at Autodrive is closing -- and our sister companies on foreign soil," says one of the lunch trio. Harris says that workers in other company closings were allowed to choose between modest severance pay and a job in a new location. Years of service were left intact for pension and vacation benefits, but seniority was rolled back to begin anew on day one of the Southfield job.

In Southfield, says Harris, the consolidation was announced to employees, and press releases were given to the media. Today, five years after Autodrive's 1981-82 transition to new products and to automation, workers overall seem content. City officials, meawhile -- who say their community is so diversified industrially they didn't feel any

economic effects from Autodrive's transition--still positively gloat over the firm's presence in town. "I can't imagine any negatives coming out of Autodrive," says the local chamber president. "You're talking about a $50 million investment, 43 cents (earned in county taxes for every dollar of Autodrive's valuation, and not including the costs of services to the plant), and you're looking at 600 jobs -- one of the highest paying types of jobs and one of the best benefits package -- and (Autodrive is) not traditional industry. You're talking about diversification."

The county manager calls Autodrive "a good and important corporate citizen supportive of community activities." The kudos from officials go on and on. They're tangible, too, in the perks the city and county handed the company ten years ago as motivators to locate here -- perks almost any rural community would trade for 600 jobs and nearly $180,000 in tax income annually. While the state provided specialty training and a service road into the plant, Dooley community leaders teamed up to contribute a 1,200-foot extension of the city airport's runway; a sewer line; and a 20-inch water line -- large for a community this size.

Then there was the matter of the annexation agreement. The year was 1981, recalls Southfield's planning director. The city was looking to annex areas north and east of the city, and the planning board was instructed to look there for viable commercial areas. That was an unpleasant revelation for Autodrive, located in the wide open spaces northeast of the city with only 17 of its 103 acres inside the city line. (One story around town, unconfirmed by Autodrive, tells how company officials, finding that they were partially in city territory, quickly moved all inventory into the county.)

But the annexation directive was something else again, and the company had a solution, the planner says. "Out of nowhere Autodrive produced.a commitment letter from the city clerk," he remembers, "a moral obligation that Autodrive would not be annexed for a certain amount of time." And, though no one wanted to defend the document on legal grounds, the council quickly backed it, going on record for an abeyance of annexation until 1992.

Autodrive's Harris recalls the agreement this way: "At that time we were trying to decide which plants.to keep open,.and I met with the Southfield city council and asked them for that commitment."

The commitment ends in 1992. Harris says that if annexation then proceeds, "It'll be a major issue" for the company. But, he expects, "We'll probably say `thank you for your ten years of grace' and accept the consequences."

Why Southfield Survived--and the Other Autodrive Plants Didn't

Southfield won Autodrive's business twice over -- in 1975 when the plant moved its axle division here, and in the first half of the 1980s when it chose the city over others as a consolidation base. Why?

"I think the attitude in Southfield was one thing," Harris says of the 1975 decision, praising the dedication of the city fathers. "I think this location, because of being right on the corner of two interstates which go from Cleveland to Florida" was another.

"Costs -- wages were definitely one. the state's approach to training and their approach to controlling costs -- I'm talking about workers' compensation, I'm talking about unemployment. Costs are very very beneficial (in this state) compared to the Midwest where we were...When we made this decision we basically looked at costs, all costs, and we based our decision on present costs of all the different locations." The availability of equity capital was not a factor, Harris says, because the company at the time had its own finance corporation.

The lack of unionization, a definite drawing card for other industries moving South, also was not a big factor to Autodrive whose Midwestern employees were organized, Harris says. But when he talks about the "trainable" work force here, he also comments on the cooperativeness of Southern workers versus sometimes suspicious Northern counterparts who look to their union steward when asked to do something new. At least one source adds that Autodrive's union might have balked at the cross-training that automation involves.

Instead, in a survey that preceded this case study, Harris gave high marks, as factors in the investment decision, to the presence of training facilities at the community college, to the proximity to an airport and federal express service, and to the help given by state commerce staff.

To the corporate vice president of human resources, the decision was simple: "We liked their business climate -- their legislation, their policies with respect to new industry. We liked the sites that were available. As to negatives, he quickly lists high utility costs.

Harris's list of state sore points includes its lack of flexibility on annexation (up north, citizens vote whether or not to annex); and the rising cost of workers compensation and general insurance.

On the decision to consolidate in Southfield rather than the Midwest, two factors were at work. One was the facility itself. Southfield's brand-new $100 plus million facility was not only on two interstates. But, says the vice president, "It was a plant that was more adaptable for our production." Harris says the deciding factor was the $6 million cost to move Southfield's heat treat process. The Midwestern plants, meanwhile, were old and unplanned.

The importance of the facility in the consolidation decision -- and in the face of foreign competition -- is also clear from Autodrive's annual report. "An integral part of the corporation's competitive future lies in the ability to continually drive down product costs through manufacturing efficiencies," the report says. "Consolidating operations at the unit's Southfield plant afforded the corporation the opportunity to install flexible manufacturing systems. The plant now has the capability to provide a greater variety of products in smaller quantities as well as serve customers with 'just-in-time' deliveries, while reducing plant inventories through new material control systems."

Looking ahead toward automation was therefore a deciding factor for the Southfield decision, in terms of its facility's flexibility. And automation was again a deciding point for factor two: training. "They were willing to be flexible and meet (our) needs," Harris recalls of the state's willingness not only to extend its community college system-based New Industry Training to Autodrive in the 1970s, but again when it changed its product line in the 1980s.

"Whatever we wanted to set up they were willing to get people involved that were specialists," Harris continues, admiringly. "They were willing to use our people, to tailor their training needs to whatever our requests were. What more could you ask for?"

The dean of continuing education at the community college, says that what Autodrive asked for -- a second go-round on training -- was not only a lot; it was unprecedented. "They'd already had New Industry Training, which you can't do (again) without special dispensation from the pope."

The "pope," in this case, was the Governor. At the same time that Harris was talking to Southfield's civic leaders about the company's woes and its need to decide where

to consolidate -- a dialogue that eventually won him the annexation abeyance -- he was talking to the Governor. Harris says: "[The Governor] made a commitment from a training standpoint and said that he would be willing to pay for the training if the decision was to close the northern plants and bring the work here."

Thus, two deals were struck.

Preparing a Workforce for Automation

The problem, Motorola Inc. found, was simply that the Japanese were better at math.

The U.S. firm was hardly the first to trip over this hefty obstacle to automation: worker inadequacy in the areas of basic engineering knowledge, statistics, and math. As a major southern newspaper reported, Motorola was trying to maintain its control of the car phone market -- and keep it out of the hands of competitors in Japan, South Korea, and Hong Kong. So it built a model automated factory.

But when the company gave its 500 employees a math test in order to run the near-perfect production line, fully 80 percent failed. And the firm was faced with the task of spending $40 million in 1986 on employee training -- simply to compete.

Motorola's experience is hardly uniques among companies in the automating mode. At Autodrive in Southfield, already 20 percent automated, success or failure on the job more and more depends on a worker's head, not his/her hands. "It makes you think. You've gotta think about what you're doing," an employee says of the computerized Mazak machining center he's at work on one Friday afternoon.

The Mazak, which performs the milling, boring, and tapping functions which once required an army of machines, is "superior" to the old days the employee declares. "It's easier to work with. When you put the right demands in [the computer], it'll take a rough piece and make a completed one."

Another employee, Bill Bennet, who moved here from the Midwest, agrees. These days are better, he says. And he seems pleased with his expertise as he adjusts complex blue and green computer controls on his "Mazatrol" to run four metal-working functions on

three pallets. "There's not too many people that can run this job -- there's some security here," Bennet says.

But these days have their own problems, he says. "It gets pretty nerve-wracking at times. You were only doing one job at a time in the past. Here, it can be one job to eleven jobs you have to keep up with. "It scares me when I'm pushing something in there. You have to figure you're right and do your best. For a younger person coming up, it might be easier."

Bennet is expressing a common notion -- that older workers have problems with computers and automation. But while some Autodrive workers have had problems adjusting, age is not a common denominator, says Jack Rainey, the area manager in cast iron machinery.

"Some of them didn't want anything to do with it (saying) `It winks and blinks at you; I don't want to touch it,'" Rainey says of the new technology. "We've had people get out of the area for fear they'd have to run one. Then we had another group that couldn't wait to get their hands on it."

So, where's the common ground? "Probably just a tenacity factor," Rainey replies. "The kind of people on those machines are the type that say `nothing is going to whip me, I can do anything.' It's self-drive, whatever you want to call it. And we have a mix of blacks, whites, males, females, young and old."

Harris says that Autodrive's manufacturing workforce is 23 percent female and 28 percent black and that he's pleased at the numbers of women willing to take a crack at the Computer Numerical Control (CNC) machines; but company personnel will not release precise figures on changes if any in the gender/racial breakdown since automation began. That mix of self-driven workers, ready for the Automation Age, were carefully picked for training on the basis of capability, not seniority, and that sometimes led to "backlash" among disgruntled employees, the manager says.

Nonetheless, the three operators chosen for special automation training were sent to the vendor's facility in Cincinnati for three weeks, and others were trained in-house at Autodrive. Wib Jones was one of the Cincinnati commuters. "This was a volunteer situation. I wasn't forced into it," the large black man in the Harley Davidson cap says. "There were people who wanted it and didn't get a chance, so I was pleased."

Watts, a high school graduate, started at Autodrive in the stock room and operated a grinder here three years. Previously, he had worked at a furniture company, running a cutting machine. Today, he's running a vertical board turning center, co- created by two vendors, Gray and Cincinnati Milicron. This beats the grinder and the cutter, Jones says. "Everything's changing, and I wanted to change with the times," he explains. "With the grinder, it was a physical thing. This is a mental thing." And as such, it can be just as tiring -- and frustrating when the machine breaks down. Further, Jones says, "The training wasn't that great. You really had to pick it up on the job." But when everything's working, Watts says, "It's pretty easy. The machine does most of the work."

The New Technology

At Autodrive, about 125 NC and CNC machines do "most of the work." Rainey describes the different categories of computerized machines: One is the turning work center. A turning work center, says Rainey, performs cylindrical work, on wheel hubs and transmissions; the part turns and the tool is stationary. At Autodrive two of these are Cincinnati Milicron CU's; one is a Mazak 40-N; a fourth is a J&L 312. The 15-CU, Rainey says, replaces an old manual lathe with pre-set tooling and stops.

Another category is the vertical turning center; again, the tool is stationary. Autodrive has four of these that are CNC, all made by Gray. Other CNC machines perform hobbing, shaping, surface grinding, and other functions.

A third category is the T-30 horizontal machining center. The tool, not the part, turns. Autodrive has four. A machining center drills, taps, bores and mills and is used to shape transmission cases and converter housings. What is significant about the T-30's, Rainey says, is that they can be upgraded annually to fit the newest technology. At Autodrive this new technology contrasts sharply with the rest of the several hundred machines out on the floor, ranging from 1940s-era lathes and drills to more modern but still-conventional turning machines.

The T-30's, the area manger says, are the closest thing in the plant to implementation of the Just-In-Time (JIT) Concept, a facet of automation introduced in Japan. JIT entails a reorganization between workers in a plant and between a plant and its suppliers and customers so that parts are made only as needed and so that almost no storage time is needed before a product goes to the assembly line. Electronic mail links to customers and suppliers are in the incubation stage; JIT is just getting started. What JIT

means at Autodrive, according to the manager, is that a product lot of 20 pieces can be run instead of 100, with practically no setup.

CIM, or computer-integrated manufacturing, is the partner of JIT, says a supervisor of Industrial Extension Service at the state university. "Companies that try to go too much to automation with one without the other don't get as much for their money. GM is a good example."

By Industrial Extension's definition, Autodrive does not have the flexible manufacturing cell, another automation facet, simply because the plant's machines for reprogrammable machine-tooling and materials-handling are not yet linked as one unit.

Plant manager Harris, however, extols the virtue of the automation Autodrive does have so far. With CNC machining centers, he says, "The operator puts the part in the machine and basically turns the machine loose. In the old days," he continues, "you had dedicated machine tools. For drilling, you used a multiple tapper driller or a radical drill. In both cases the guy physically did the work.

"In the old days you'd spend hours at setup and virtually a few minutes running the part. Today, you spend more time running the part, but there's basically no setup."

Another area of automation at Autodrive, Harris says, is material handling. With this area, "We used to pick all the parts, put them on tote racks and then all the tote racks would be pushed into the assembly area. Today, we have an automatic storage and retrieval system with a conveyor system where we reload all of our small parts on a conveyor, and they're delivered to the assembly area." Indeed, out on the plant floor, a young employee simply presses a computer keyboard to control a huge arm that dips into drawers stacked as high as the ceiling -- a scenario somewhat reminiscent of a huge auto parts store -- and finds the right parts to place on a conveyor belt. Just months ago, the employee says, hers was the arm reaching into the parts drawers and running back and forth to the conveyor belt.

At Autodrive, assembly is still done by hand and conventionally; so are many of the turning operations. But one more area is automated: inspection. "You load a part onto an automated inspection machine, basically set the part up and find the axis so it's square," Harris says. "You basically run three bores, and that identifies the actual rotation of the part and automatically checks the dimensions and locations of all the other things." In the past,

he says, "You went into each bore with a probe by hand to make sure each dimension was correct."

Obviously, automation has its high points, but there are negatives, too. One is that the transition Autodrive has experienced has temporarily lowered productivity. Workers simply are still learning their new duties, Harris explains. Equipment utilization is very high in this new type of process, and planning must be much better than it used to be. Under the former system, inventory was dispersed throughout the plant. Now, it is concentrated at specific machines, which requires tighter control. "It's a new thought process that our old managers have to go through," Harris stated.

It's also a thought process that companies like Autodrive are experiencing more and more, according to Moore, the editor of *Metal-Working News*. The industry is on a par with or more automation-minded than, other manufacturing categories, Moore says, and "My impression is that fabricators like Autodrive are rather keen on automating." In Southfield, according to Corona, Dooley's economic development director, Autodrive is one of the most automated plants, but others are in the process.

The common thread of anxiety towards these automators of course is jobs -- will they be taken away? Will lifeless robots steal livelihoods?

At Autodrive, Harris says, it's hard to answer that question because automation began simultaneously with consolidation. "We eliminated machines that were underutilized -- something like 96 machines utilized 5 to 30 percent of the time," he says. If jobs were lost in Southfield as a result of the CNC machines' introduction, they're hard to trace. As for people, no one was laid off. Instead, natural attrition was allowed to occur, and temporaries also were brought in as replacements. "We will not reduce our permanent work force over that period of time," Harris says. "Our feeling is that as we improve our technology and reduce our costs, our business will grow."

Teaching "The Basics" for Automated Jobs

On a weekday afternoon in the smoky, panelled waitingroom of Dooley County's Employment Security Commission (ESC) office, the receptionist is describing to an applicant -- for the nth time -- the job requirements for Autodrive inc.

"Long drawn-out process." "Two hours a day, two hours at night," she is heard saying across the drone of waiting room conversations and the shrieks of a child at play on his mother's lap.

The date is a Thursday in August, and ESC is in its fifth application-taking for Autodrive's newest hiring phase, which started in July, the receptionist says. According to Autodrive's information sheet, applicants must (1) be able to read and write; (2) take a general aptitude test; and (3) undergo pre-employment training of four hours a day for five days. Then they enter an applicant pool from where they may or may not be chosen, according to a series of interviews.

One particular job category open is "operator," starting at $8.77 an hour and rising to $10.14; this company prefers a year's experience in metal shop set-up. Another job open is materials handler, starting at $8.31 an hour and the company is looking for six months experience in shipping, receiving or stock room work.

Sources describe these wages as average for the industry and above average for Southfield. Harris says that in general the automation push has not caused pay to go up for jobs at Autodrive. But, according to the ESC Manager, openings like the ones at Autodrive require new job skills -- the ability, as he describes it, "to be more than just a machine tender." Instead, he says, a distinction is now being made "between a machine tender and a machine operator -- a `tender' being less involved in the actual operation of the machine....He (the tender) could be just watching and told `if this light stays on you do nothing.' The operator, however, has to be able to make adjustments."

More and more, the ESC manager says, plants implementing automation are requiring reading and writing skills -- something new in the land of textiles and furniture -- as well as the ability to conceptualize for problem-solving. "The labor force is becoming more and more complex," the manager says. "We have a company that makes parts to make a complete product, having requirements put on for higher quality control, more paperwork to track the part...There's pressure for being more accountable for what you are doing. And very few people want to be accountable -- especially the marginal worker."

What is the general picture of automation? The ESC manager believes that a loss of jobs has occurred, but not on a large scale, and that some companies have rehired after layoffs as production increased. "When the labor market is tight, it's the applicant's best time to get a job because the employer can't be picky....Some companies now, to meet

production deadlines, are hiring people who, in normal times, they wouldn't hire." Some companies, the ESC manager adds, also are answering the potential job loss quandary by using temporary workers. Temps, he remarks, "are a heckuva way to save money."

For operator jobs at Autodrive -- temporary or permanent -- applicants take a state-administered aptitude test of two-and-a- half to three hours that measures mathematical ability, finger and manual dexterity for assembly work using washers, rivets and pegboards. The test has been in use for one year.

The next stop is the community college, where continuing education classes supply training in metal-working basics: blueprint reading, math, the use of measuring instruments like caliphers and micrometers, and the use of conventional metal-working machines like grinders and drills. Autodrive Manager Harris describes it this way: "We're asking more than literacy. We're asking for the capability to think, the capability to reason and the capability to get along with people." The Personnel Manager confirms that Autodrive has changed from the days when entry level people with minimal or no skills were taken on. More and more, they both say, the "basics" and that intangible ability to learn are what they want.

The college, which joined the state system in 1973, has been teaching those basics to Autodrive employees since 1976-77. That year, experts supplied to Autodrive through the community college's new industry training program set up for business on the company's newly cemented floor and brought in metal-working machines. A full-time trainer was hired, and Autodrive was reimbursed for its employee-instructor. The course lasted 320 hours. That first training program, for which the state paid $250,000, lasted until 1979-80 The second training in 1982-83 and 1983-84, when the plant was retooling, reached 324 people and cost $378,000.

The process was smooth, and it continues, in the form of cooperative skills training in which as few as one or two workers can receive updated training. Classes for trainers themselves recently have been completed at Autodrive, while more in-plant classes for machine operators are scheduled.

Overall, the Dean at the college is satisfied with the philosophy of teaching "the basics," and he says so strongly. "The way I view machine shop training, there's no way you can take someone and make him a tool and die maker. It takes years," Freeze says.

"So you train him in instrument reading, blueprint reading and traditional machines. So if they have all these basics, they can go in and get trained."

Does this mean CNC training should be confined to the plant? Not necessarily, the Dean replies. In fact, the college had a state-loaned CNC simulator at its disposal several years ago. But, at the time no one was interested in training on it.

CNC and Automation Training

The chairman of the engineering division at the community college, believes he knows the reason why there was no interest in the CNC equipment and why the college's machinist program never attracted more than ten students and had to be discontinued last spring.

"They were converted manual-to-NC machines from 1920 to 1940," he says of the machine shop college students were using. It was set up in the school's body shop, from 1984 to 1986, by the generosity of Autodrive. But the machines were old machines that Autodrive was discarding, not the CNC machines it was bringing in, the chairman laments. "A lot of them were antique junk that they didn't need, to tell you the truth. And a lot of what they had in there didn't run."

What the Chairman is saying is not so much a criticism of Autodrive as an implicit criticism of the state's community college system. According to the chairman, computers attract students; that is a fact of life. When a CAD (computer-aided design) machine was installed in the drafting program this year, enrollment jumped from 20 to 80 students, and fully 40 of those 60 new faces credited the new equipment. "With welding, the machine program, some automotive classes, the numbers have dropped off because that's where you have to do something with your hands where you're going to get dirty," he says.

"With the other ones -- automotive electronics, industrial electronics, industrial maintenance and drafting, the numbers are up. Maybe there's a little more prestige there, maybe a little more money."

But money isn't coming to buy the CNC-operated mills and lathes and cylindrical grinding equipment he says he needs. And such new technology-to-learn-on is missing in a number of the state's community colleges while selected schools get extensive and expensive automation programs.

"We got started in the community college business late -- we didn't come in until 1974," the Chairman says describing these other programs he sometimes envies. "Most of those boys got in early."

The associate director for engineering technologies within the community college system offers another explanation for the variance. "That institution has had a lot of trouble getting vocational programs off the ground (because) they're not seen by the board as being as important as the academic side," he says.

Another reason given is the local initiative on which each of the state's machinist curricula depends. Does politics make a difference? "Our institutions are tremendously competitive, and in some cases (politics) does just that," he says. Others comment, sardonically, that one reason behind another school's model automation program may be the presence of an influential legislator who hails from nearby.

Still another reason for a model program is just good old-fashioned hustling. The director for the machinist program at Norlin Community College in an adjoining county, Milt Weidman, describes his fund-raising efforts for his school's programming course, which includes use of a $75,000 CNC turning center made by Moresiki and a $75,000 machining center. He describes how within the next year these CAM (computer-aided manufacturing) machines will be linked to the CAD facilities of the school's Engineering Technologies Program.

Included will be an automated manufacturing laboratory, which will be assembly-oriented with robots working as a group. Already, that school's CAD program has $2 million worth of machinery: eight Computervision CADS-4X terminals, IBM drafting terminals and 20 microcomputers. The new program will add 78 terminals and a Technovate, or robotics work cell combining robots and terminals to simulate inspection and assembly. The Technovate cost $80,000.

And Weidman thinks such expenditures are worth every penny. "I think it's our job to help train these people," he says. "I think a student should leave my program with a basic knowledge of CNC programming as well as operations. If they leave a machine shop here to go into industry, they're going to come in contact with CNC. So if all they've had is basic lathe and milling, they're going to be out of it."

Industry underlines this view, Weidman adds. "That's why we have this equipment. The advisory committee said, `If you're not going to put CNC equipment in, you might as well not teach it.'"

An obvious question, however, is where to draw the line. In South Carolina, where vocational programs are centralized, Greenville Technical College is the CNC center. And Charles Granger, head of the Machine Tool Technology Program, is proud of his five, $145,000, vertical machining centers; his $245,000 Cincinnati Milicron turning center, his $240,000 T-10 horizontal machining center. "Would you believe we have people from as far as Alaska?" Granger asks.

But here sources are skeptical of both this centralized approach and its elaborate resources: "I'm not sure if you had all this expensive equipment, it's worth anything to these students," the local college chairman says. "If you put one on it, he might ruin your equipment, and it might discourage the student."

Weidman at Norlin Community College agrees. "Every county doesn't need its own automation lab, but potential employees need to know robotics in the general area," he says. "Its unrealistic to think they'll go to to the state university. There's a happy medium there someplace" -- between a centralized scenario like South Carolina's and the competitive county-by-county approach here.

Where Do the Training Needs Lie?

At Autodrive, Manager Harris still talks about the basics and about learning ability, but, pressed, he acknowledges that CNC training might be useful: "My feeling is, give 'em some of the basics, get 'em onto the CNC, get 'em some of the preventive maintenance stuff. But the real concern expressed by management is how to teach somebody to think, to have the right attitude? One suggestion is teaching students about the business world they work in, which ought to give them necessary perspective.

"The Koreans (working) at 80 cents an hour," Harris says by way of a syllabus. "That's one of the things people around this plant understand. That plants close. That when you're not competitive, plants close."

Back at a nearby community college, an instructor talks about the need for smaller classes. He has resorted to using a video screen so his average class of 10 or 15 can view the controls on the machines during student practices. He also speaks of the "junk in our

equipment" -- the two engine lathes from India for instance that fell apart -- which the state's bidding system foists upon him. Spending a little more money for a quality American machine, like the 1943 Monarch lathe he has that's still ticking, makes sense in the long run, he believes.

Still another authority from the state's industrial extension service, worries aloud about inadequately trained factory managers who don't know how to deal with the incoming technology. "Frankly, the education needs to be applied at the top, not the bottom," he says.

And Moore, the editor of *Metal-Working News,* suggests that what is really needed is computer literacy training at the high school level. The computer literacy coordinator for the Dooley County schools echoes the thought, saying, "During the past three years our main emphasis has been to get every student `computer literate.'" She says she's talking about 10,000 youngsters, kindergarten through grade twelve.

Already, integration of the computer is taking place in all subject areas, the coordinator (and wife of the county manager) says. Job-related courses at the high school level include computer accounting and data-base management. This past summer, the schools also offered a course concerning application of computers in technology.

On the technology side itself, says the administrative assistant for vocational education, Wilson Finney, the Dooley Schools this past summer further offered a course designed to attract non-college-bound eighth grade girls into higher paying electronics jobs. Computers were used; so were "Mr. Circuit" electrical components kits. The students, he laughs, re-named the kits "Ms. Circuit."

More is coming down the track, Finney says. The schools last spring sent to local industry a survey asking what types of jobs are actually available. The goal, he says, was to tailor future vocational training towards the actual needs of potential employers.

To do this, the educator says, internships for high school youngsters unacquainted with various industry categories could provide a crucial introduction to automation. "We cannot get our students placed in industry because industry will not take our kids unless they're 18 years old," says Finney, citing insurance restrictions and the vagaries of business.

In the automation age, Finney says however, the earlier young people get acquainted with the new technology, the better.

Conclusions

At the turn of the nineteenth century, a French inventor named Joseph-Marie Jacquard perfected an automated loom for cloth containing decorative patterns. Holes punched in cards determined which threads would be raised and lowered; cards fastened together to form a continuous tape allowed the creation of intricate designs.

But workers balked at the new machines. Although intrigued at this pioneering effort to change a machine's behavior through programming, not design, workers smashed and sabotaged those same looms that were taking their job.

But by the 1980s, automation has become an accepted fact. Children still in elementary school play with video games; college students write their term papers on word processors; and adults long used to primitive typewriters exult over the miracles of a technological revolution rapidly expanding in their lifetimes.

But along with automation come a variety of concerns. And although job loss was not a problem at Autodrive, other issues -- in terms of the firm's impact on its community and work force -- deserve consideration.

Suggestions and Comments

The case suggests a number of areas that bear futher examination. First, the educational needs of an automated facility are quite different. The description of automated jobs at Autodrive suggests the need to start computer literacy early in the school years. The job requirements Autodrive lists at the Employment Security Commission highlight the increased need for reading and writing literacy among adults. Further, Sam Harris speaks of his need for workers who can think, who can visualize. The message is that the era of textile and furniture workers without these basic skills is over.

Training has to begin early. A Dooley County Schools Administrator offers the intriguing idea of industrial internships -- something akin to professional internships that

college students enjoy. High school students -- particularly women and minorities -- need nurturing environments in which to make career decisions. An official of a nearby Technical College thinks "the basics" for metal-working jobs -- blueprint reading, micrometer use, etc. -- are no longer enough. It's important to note that Dooley County enjoys diversification and low unemployment now. But should that situation change, employers may well ask for more. The problem for CNC, CAD and CAM training, of course, is the expense of the equipment involved. So state leaders might want to review the current community college system that allows a patchwork of good versus poor resources for such training. Should a state have a regional approach that makes high-tech training equally accessible in areas of greatest need?

A second issue has to do with plant closings and employee job security. The uncertainty of a company like Autodrive in the face of offshore competition only underscores the need to review the frameworks in place for workers. As the ESC Manager suggests, the frequent use of temporary workers by Autodrive and other Southfield-area firms in the automation process highlights the need to review protections for these workers who typically lack insurance and other benefits.

A third issue is the extent to which the community can respond to the needs of industries that are in a state of flux. The willingness of Southfield's leaders to be flexible in the annexation abeyance helped make the difference in Autodrive's decision to keep its Dooley operation open. What flexibility is available at the state level? If a plant wants to expand in order to automate, can it count on the same incentives -- service roads, airport runway extensions, etc. -- it initially received? Should the state conceive some sort of motivation/reward system for the wave of automation planning that is inevitable in the South in general and in the state in particular?

A Final Note

At Autodrive, automation is well underway. An unnamed worker is proud as he sets his T-30 to run a part, and he happily crows that he is supposed to be at 12.184 inches and is actually within three 1000th's and seven-tenths. "This beats a radial drill, there's no comparison," he declares. And not far away, another worker at a machining center, is saying: "I think eventually all the machines will be CNC-controlled. And if you don't learn CNC controls, you won't have anything to do."

But is this a statement of resignation? Or is it an expression of satisfaction that brains, not brawn, are finally called for in the blue collar world? "As long as I have to get my hands dirty, this is how I want to do it," the worker says. When he turns back to his computer screen, he's wearing a grin.

CASE STUDY II
"WE'RE NOT PRODUCING HEIRLOOMS HERE': *HANOVER INDUSTRIES*[1]

by Marybeth Dugan

Introduction

"This technology today is moving so fast that yesterday's way of doing anything is wrong; I don't care what it is, it's wrong." So speaks the general manager of Hanover Industries, a highly automated furniture plant in a rural area of the South. With this kind of thinking, this kind of pressure to stay on top of the rapid changes taking place in production technologies, it is easy to understand why manufacturers today are trying to remain competitive by investing in the most advanced, and the most flexible, technologies available. In the South, traditional industries, such as textiles and furniture, are trying to maintain their foothold through the adoption of new, computer-based technologies. In this case study, however, Hanover Industries represents a new breed of furniture plant, quite different from its traditional counterpart in both its product and its process.

In the 1960s, acquiring furniture companies was common for large corporations seeking to diversify and expand their operations. The plant in this case study grew out of such an acquisition. In the late 1960s, Hanover International bought a traditional manufacturing company. Understanding the limitations of both its experience and its ability to compete with traditional furniture, Hanover decided to leave the traditional concern as it was--producing top of the line, or "high end" furniture--and to create a new division, Hanover Industries, whose niche and competitive edge would be based on new technologies. Instead of producing high end furniture, the division uses its technological advantage to produce "low end" and ready-to-assemble (RTA) furniture. The study plant began operations in 1974, and up until the development of a second facility this year, it represented the entire division.

Traditional furniture manufacturing typically requires low capital and high labor inputs, where quantities are small and where precision is not essential. Hanover Industries, on the other hand, has followed the route of its parent corporation, making low end furniture at high volume and low cost with high capital investment and low labor input.

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[1] All names in this case study have been changed to conceal the identity of the company.

Both the product and the production schedule require equipment that is not only high speed but precise. And the constant and unpredictable style changes inherent in this fashion-based industry require a production process that is flexible and responsive not only to style-related changes but to product changes as well.

The following case study elaborates on the implications, for both Hanover and its home community of Lee County, of adopting new technologies in the workplace. In this rural community whose economy is dominated by the furniture plant, the development of local resources and public policies and programs--particularly those relating to human resources development--has been inextricably tied to the development of its number one employer.

The Community

General Characteristics

Like many parts of the South, Lee County has deep historical roots in the War Between the States, and the rebel tradition continues, though the subject of the rebellion is no longer the federal government. Local residents instead declare their independence through the absence of strong local government, and through an apparent distrust, or disillusionment, with state government. According to one member of the community who was involved in an unsuccessful attempt to sustain a local community development corporation, local government is endowed with limited powers by its citizens. "This is one of the most conservative counties in a very conservative state...Zoning is as bad a crime as rape. You mention zoning and people come out of the woodwork, and they bring their guns." Although this may be an exaggerated characterization, a strong sentiment of independence and individual rights is apparent through conversations with local residents. This sentiment, in turn, is complemented by a labor force with a self-proclaimed "good work ethic" in a right-to-work state.

Lee county is without an administrator. The county seat, one of two incorporated towns in the county, employed a town administrator for a few years in the early 1980s, but the town was unable to pay him a competitive wage, and it has been without an administrator ever since. There is a town council and a mayor; the mayor works at the local funeral home. A three-member Board of Supervisors is elected for the county.

This past summer, a Board-appointed commission released a blue ribbon report recommending changes necessary for the future development of the county. The report's first priority is the hiring of a county administrator, and the second the development of a county zoning plan. As might be expected, this second objective is already coming under sharp criticism, according to local newspaper articles. Ranking number five on the list of recommendations is the development of basic infrastructure, specifically a "water distribution and sewer collection system."[1] Hanover Industries is located within the town limits and therefore receives the benefits of town water and sewer. But the town system is short on capacity, and the county is without any, hindering the prospects for significant future growth.

Like most rural counties in the South, Lee County lags behind the state in certain economic indicators. According to the 1980 census, per capita income in the county was 73 percent of state per capita income, yet at the same time, the percent of persons below the poverty level was slightly lower for the county than for the state. These indicators are explained by the predominance of low-paying manufacturing jobs and relatively low unemployment rates. Finding a job may not be difficult, but finding a high-paying job is.

Minorities in the county account for about 23 percent of total population, higher than for the state as a whole. Lee County also lags behind the state in educational levels. In 1980, the percent of persons in the county age twenty-five and over who had completed twelve of more years of school was 69 percent of the state level; the percent of county residents with sixteen of more years of school was only 38 percent of the state level.

Consistent data on the local economy are hard to find, in part because there is no local government collecting statistics, according to the regional planning council that oversees Lee County. For June 1987, the regional office of the state economic development agency lists the county's unemployment rate at less than 4 percent, while the planning council lists March 1987 unemployment at 5.3 percent. (versus 5.2 percent for the state and 6.6 percent for the US as a whole).

Manufacturing jobs dominate the county's economy, accounting for almost 60 percent of all jobs available. Hanover accounts for more than half, with almost 1000 jobs, while apparel firms--some of which have been in the county for generations--make up the difference. Hanover pays the best wages in the county, though they are low relative to the

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[1]Objective number seventeen is the establishment of a water and sewer authority--following number sixteen, which calls for "developing a plan for the establishment of a modern motel/restaurant facility."

median wage rates in the nearby metro area. The wage scale for production workers at Hanover ranges from $5.46 to $9.53; for maintenance workers, the scale ranges from $6.32 to $11.71 per hour. Men fare the worst in terms of finding employment in their county of residence, since the apparel firms employ almost all women, and women comprise about 50 percent of the labor force at Hanover's furniture plant.

The balance of the economy indicates that the community is undoubtedly dependent on a nearby metropolitan area not only for the provision of retail goods and services but also for employment for county residents. The local retail sector in the county is quite viable, accounting for over 15 percent of county jobs, but it is primarily limited to food stores, automobile dealerships, and restaurants. Local retailers are quite dependent upon the presence of the furniture plant, not only in terms of payroll spent on local goods but also in terms of the business they do with Hanover itself. The service sector is the least developed, with the proportion of jobs in services in the county only one third of the proportion in the nearby metropolitan area.

In terms of providing jobs for county residents, the nearby metropolitan area is very important. Although Hanover draws its labor force from a six county area, more Lee residents travel outside their home county for work--primarily to the metro area--than vice versa. The regional manager of the state economic development agency considers the low unemployment rate in the county to be an indicator of the unavailability of labor--a potential hindrance to further growth--but local residents, and local employers, disagree. "We have two thousand applications on file," according to the personnel manager at Hanover who estimates that Hanover has hired 160 people in the last year.

Another local employer says that if he put an ad in the paper for a secretary he would be interviewing non-stop for two weeks, and interviewing people who are presently employed. From his perspective, the applicants would not be unemployed. Rather they would be working in the nearby metro area, but they would willingly work for less in order to work closer to home.

Although Lee County is quite rural, with a population less than 13,000, the adjacent metropolitan area has a population near 150,000. The county seat, where the Hanover furniture plant is located, is about 25 miles from the city, and the town and city are connected by a four-lane state highway that ends at the entrance to the plant. The metro area provides an array of services to the company--dry cleaning services, electrical supply houses, wholesale facilities.

Proximity to the metro area is important to the plant's location, and the presence of the four-lane highway is *very* important. The company found the location for its plant through the railroad that runs through the town, and initially much of the plant's materials and supplies were delivered on a rail spur running into the plant itself. Now trucking is far more important, with in-coming raw materials and out-going finished goods transported predominately by truck. Almost all of the trucking services are contracted out.

The Corporate Citizen: Hanover-County Relations

A retired Lee County extension agent and member of the Industrial Revenue Authority who has been very active in local economic development efforts in Lee described Lee County before the arrival of Hanover Industries as a bedroom community for the nearby metropolitan area. "The taxes paid on houses and cars was not enough to support a school system. The arrival of Hanover reversed that [bedroom community] trend." Now, Hanover Industries is the number one tax payer in Lee County, contributing more than 9 percent of the total county taxes. With the investment in automated equipment during the last three years, Hanover's personal property tax increased by more than 22 percent.

Local communities with well developed economic development efforts often offer a package of goods as incentive for attracting businesses and for assisting existing businesses in expansion and modernization efforts. But the management at Hanover Industries maintains a philosophy of self-sufficiency in terms of the public goods it expects from local and state government. "We did not ask the local municipalities for anything. I think a private company ought to go into a community on its own and not hold them up for money--that to me is not right," says Hanover's general manager.

According to the county extension agent, who was also involved with negotiating Hanover's move to Lee County, Hanover Industries was never interested in revenue bond financing, or any other incentives. The only contingency to Hanover's arrival was that the land it bought be annexed by the county seat, providing necessary water and sewer services to Hanover and an increased tax base to the town.

According to the general manager of Hanover Industries, Lee County was also selected because of adequate labor supply and because it provided certain amenities desired by a salaried organization, namely the building a new high school and the addition of a clubhouse to the local country club.

When asked about how the absence of a strong local government affects the operations and decisions of the plant, the general manager said that it neither made operations easier or more difficult. Yet in an incident in which a nearby resident complained of noise pollution at night from the blowers that carry saw dust out of the production area to the on site power plant, the general manager recounted how the "town fathers" were able to ameliorate the situation through direct, informal communications with the resident. Such problems are undoubtedly easier to address in a small community, especially for such a large employer.

When asked if Hanover Industries is a good corporate citizen, the county extension agent instantly responds, "No questions about it." And the management at Hanover would agree. Management personnel at Hanover are involved in various community groups, and the company supports the local schools by participating in the high school's work cooperative program, supplying the high school band with uniforms, and donating computer equipment to the school.

The Automation Decision

Background

The Hanover plant began operations in 1974 and, up until the late 1970s, produced plastic overlay furniture. As that style of furniture became less popular, the plant began a switch-over to all wood construction. It is this change of product that spurred the recent investments in new automated production technologies. The original equipment was state-of-the-art by 1974 standards, but by the 1980s was outmoded. So in the process of changing product, the plant began an equipment upgrade program in which "every new piece of equipment we buy today is run by computers," according to the general manager. "We buy virtually nothing that doesn't either have a mini-computer up to a full scale computer."

Most of the new automated equipment is foreign made, mainly German and Italian--"the Italians are famous for their angular saws"-- and to a limited extent Japanese. European equipment accounts for roughly 60 percent of the new investment and Japanese 10 percent. The remainder is American-made. In planning the product switch and the simultaneous decision to upgrade equipment, the management at Hanover chose what is called the 32mm system for its production process. At present, Hanover is only one of three or four US manufacturers using this post-World War II European design system, and

equipment for this system is not even made in the US. The 32mm system differs from its traditional furniture manufacturing counterpart in that instead of assembling furniture frames with mortise and tennon joints--a high labor, low capital practice--component parts are bored and doweled according to exact fastening specifications. This process involves low labor and high capital inputs and gives, according to the general manager, total control over the production process through its high degree of accuracy.

In addition to the investment in production equipment, the Hanover facility has undergone a series for four expansions since 1974. In fact, the building was built with panelled outer walls, ready for expansion at any time. The net result of these expansions has been a doubling of the plant's square footage, from the original 400,000 to 800,000 square feet. Most of the newly created space has been devoted to warehousing, "goods in process storage," which accounts for 30 percent of total available space.

According to the Material Requirements Planning (MRP) manager, instead of the automated production reducing the need for inventory, as is often the case with automation, the Hanover plant has actually had to increase its inventory. Not only is the plant producing in greater volumes, they are producing for retailers who call in orders for immediate and short notice delivery for a variety of products. For these two reasons, the plant needs to maintain a large and diversified inventory of parts to meet retailers' schedules and volume.

The Investment Decision

"Jim wants total control over product," according to Hanover's manager for production engineering. Jim is the general manager, and just as he believes a private company ought to come into a community on its own, without the help of public resources, so, too, does he believe that investments to modernize and upgrade equipment ought also to be made independent of public assistance. This attitude is in part a function of his personal philosophy, but also a function of his heading a corporate division.

Unlike a branch facility, which is usually devoted to production without the necessary engineering support staff on-site, Hanover Industries is a division and therefore has its support staff on-site. Such on-site support has been increasingly important as the production process becomes more and more automated. At present, the non-production work force accounts for 17 percent of total employment at the plant. Engineers make up 9 percent of the total non-production work force, and production supervisors and other

management--many of whom have engineering degrees--account for over forty percent. Technicians, mainly draftspersons operating computer aided design and drafting (CAD) equipment, make up another seven percent of the non-production work force.

As a result of both its self-sufficiency philosophy and its divisional status, Hanover Industries does not take advantage of available state resources--such as industrial extension services, university-based and state supported centers for advanced manufacturing technologies, and centers for productivity improvements--in its decision making. Hanover's general manager directs the new equipment investments at the plant. Usually with the company of one member of the engineering staff, the general manager is constantly traveling throughout the US and Europe, talking with machine and equipment producers, visiting trade shows, and trying to keep on top of the cutting edge technologies in the assembled furniture industry.

Other actors also involved in the equipment decisions include production and general supervisors since "they are the most knowledgeable in what needs to occur on the equipment," according to the general manager. Maintenance is also involved since the selection must take into account maintainability and reliability features. Final decision lies with the general manager and engineering.

Besides buying equipment associated with the 32mm system, Hanover has been directly involved in the development of the automated equipment it has invested in over the last three and one half years. Hanover Industries has participated in joint development projects with various machine making companies, many of whom are located within a 100 mile radius of the plant. The partner company in one joint project is characterized by Hanover's general manager as having good machinists, but lacking in engineering know-how. Because of this, Hanover is "lending" one of its engineers to its partner for the duration of the project. If the development fails, each partner pays half the cost; if it succeeds, Hanover Industries has exclusive rights to the equipment for a yet to be agreed upon period of time, anywhere from six months to one year.

Another joint development, involving a local independent machine designer, resulted in a $100,000 computer-controlled clamping machine in assembly. The clamp represents the largest order the machine designer has ever filled. The management seems committed to using local machine shops in its development efforts whenever possible. One machine company, located in a small town about an hour and a half away, has repeatedly

worked on projects with Hanover, which usually supplies its engineering personnel to the company during product development.

The largest development project undertaken by Hanover Industries dealt with more than a single piece of equipment. For two years, the company's product development team--the general manager and staff from production engineering--worked on the question of what to do with the finishing area of the plant. "The idea of a finishing room goes back to the 1920s, and we had a finishing room because that was the way its was done [in the furniture industry]," says the general manager. But the labor-intensive, time-consuming work of the finishing room did not fit the vision of an automated production line turning out high volumes of promotional priced furniture. The result of this two-year development project has been the gradual elimination of the post-finishing process.

The self-described "darling child" of Hanover International, Hanover Industries has been the most profitable division and has had no problem acquiring from the corporation the capital necessary for its investments of the last three years. The general manager is on the corporate board, so approval of projects is, he says, "fairly easy." Hanover Industries has not had to go outside the corporation for financing its expansions and equipment upgrades at this site.

The Production Process

The plant is divided into two main areas, the first devoted to the fabrication of parts, the second to assembly operations. The recent investments in automated technology have occurred in the fabrication area, but future investment efforts will concentrate on assembly. Although the plant is committed to a European system, the 32mm system, the set up of machines throughout the plant suggests that individual tasks are automated as problems or possibilities of improvements arise in a given area. New equipment is purchased to improve a task or introduce a new one, but the movement of parts from one machine to the next is, in almost all cases, manually operated, through forklifts, rollers, or dorries.

A small amount of pre-finishing is done at this site. Large particle board panels are surfaced treated and a simulated veneer is printed on the prepared surface. A rough top coat is applied and actually pre-finishes the board. After the pre-finishing, the fabrication line begins with two large saws. The first is an older, American-made saw that is computer controlled. The computer stands about six feet high, four feet wide and three feet deep,

and has a control panel adjacent to it. The computer and controls are located in a separate control room because of the computer's inability to operate properly at temperatures above 70° F. The computer is fed a program tape that dictates to the saw what pattern to cut the board. After the board is cut, the pieces are manually measured to test the exactness of the cut. Pieces cut from the American saw must be only to within an eighth of an inch. The person measuring discards those pieces that are not properly cut and sends the others on to workers for sorting.

In contrast, the Italian saw, introduced this year, is much quieter, and much smaller. The control panel has noticeably fewer buttons, is more streamlined, and sits in the open, adjacent to the saw. This computer is also programmed to direct the pattern of the saw's cut, but the cut is so exact -- to within half a millimeter of the programmed specifications -- that it does not require a worker to check the measurements of the pieces. Although the Italian saw takes a longer time to cut, it cuts eight boards at a time, versus five at a time on the American saw. In addition, the cutting blades of the Italian saw are protected and for the most part out of reach, making it, from the perspective of the safety manager, a much better saw.

But according to the operator sitting behind the controls of the Italian saw, his machine is much less reliable than its American counterpart. This sentiment is reiterated, with a certain amount of pride, by the operator of the American saw. The Italian saw not only suffers more down time, it is harder to troubleshoot and get back on line after it goes down. During this site visit, the operator of the American saw agreed to demonstrate his machine, as it was not in use at the time. He deliberately chose a complicated cut, but something kept going wrong and the computer registered error signals. After about three minutes of the operator pushing, poking, restarting, and re-entering the program, the saw still did not operate. The operator's final attempt was successful--he opened up the circuitry of the computer and blew a fan directly into it to cool it down. The board was then cut.

After the cut parts are manually sorted, they are transported to either inventory or the next cutting phase. Pieces from the American saw almost always require further cutting to meet specifications, while pieces cut from the more exact Italian saw rarely do. After this step, pieces are shaped and foiled as necessary, and sanded. Some pieces are then routed by newly installed, Japanese-made, computer-controlled routing machines.

At the end of the fabrication process, a long, automated machine drills holes in the boards and inserts dowels, readying the pieces for assembly. Again, improvements in safety are apparent. The drilling and doweling machine is encased, with glass doors that allow monitoring of the machine's workings while providing a protective barrier between the machinery and the workers. The computer controlling the drilling and doweling machine is housed along a wall parallel to the machine.

The assembly area is obviously less capital intensive and much more labor intensive than fabrication. With few exceptions, including the automated clamping machine described earlier, workers are responsible for putting the fabricated pieces together. There are three assembly lines, one of which goes on to the finishing room, though the finishing room will be completely phased out by 1989.

The third important production area is inventory and its associated Material Requirements Planning (MPR). This area is also heavily computer controlled, for reasons mentioned earlier, and represents an almost superstucture to the areas of fabrication and assembly. The MRP system at this site is tied to a mainframe computer at the home office of Hanover International's high end furniture company, in another southern state. Two computer stations are located on the shop floor, one in fabrication and one assembly. The computers are constantly printing out which pieces to move where, and persons performing materials handling functions proceed accordingly.

In addition, a large, and recently expanded inventory storage area is completely computer controlled, with automated material handling equipment placing inventory in a storage area made up of cubicles. The cubicles are stacked in eight rows, each about three stories high and one hundred yards deep. The computer knows exactly where the empty cubicles are and what each contains. Workers on a line needing parts report, in person, to an office where the computer is housed and place their orders. The computer controlled equipment retrieves the necessary parts, which are then transferred, usually via forklifts, to the appropriate line.

Implications of Automation

Production

"Our employment keeps going up," states the general manager, "but our direct labor as a percent of sales keeps going down, because of the automation." Automation at Hanover has not only improved productivity measures, it has also increased capacity--though the plant manager refused to describe such increases in detail,--output, and to some extent profitability.

Hanover Industries is currently producing at tremendous volume--5000 pieces of furniture a day. That translates into 25-30,000 component parts per shift.[1] As one worker proclaims, "We're not producing heirlooms here."

One reason for the increases in productivity and output is the decrease in set-up time. With computerization, set-up time has decreased from one and one half hours to ten minutes, making set-up an insignificant obstacle to changing production schedules. As the MRP manager describes it, "You can run so many different parts in an eight hour shift. If you had four set-ups before, you'd only have 50 percent run time. Now with four it's only forty minutes [of set-up], so your capital utilization is so much better. [Before], labor just stands there while you're setting up--the meter is running--so the cost of your set-up is the labor dollars standing around."

According to the manager in charge of sales and customer service, "I've seen this whole revolution in technology and it's the only way we've been able to stay as competitive as we are...We have one customer who sold 4,850 pieces [of our new furniture line] in the last two weeks, just on local ads. The technology allows us to make a lot of [furniture] fast at a lower price...We could not operate this product line, [or] provide the service that we do, without the computer technology."

From the perspective of the general manager, who is concerned with style and product, the new automated production technologies have provided "tremendous flexibility " in the production process. The new technology allows for a wide range of style changes without requiring changes in equipment. The plant manager, on the other hand, being concerned with output and productivity, says that automation has decreased flexibility at the

[1] The plant operates three shifts. The first and second are devoted to both fabrication and assembly, the third to fabrication and maintenance.

plant. In order to maximize the potential of the new machines--producing the highest volumes at the lowest cost--the machines ought to run as if they were dedicated, i.e. performing a single task over and over.

For the MRP manager, automation has greatly increased flexibility. It has allowed him to be more responsive to retailers orders, and to provide greater customer service and satisfaction. "We're the promotional price furniture business [for the big retailers]. We sell to people who buy truckloads of our furniture--real tonnage. So when they have a promotion, we tend to be the lowest priced furniture...trying to attract buyers for the more expensive pieces. But an awful lot of people buy the advertised stuff, so we can be the highest volume that these retailers turn over." From this perspective, the automation provides a means of reacting to and satisfying a volatile retail market.

Human Resources

At Hanover Industries, automation has affected both the quantity and quality of the labor required of *all* workers--production, engineering, maintenance, and even management. In absolute numbers, employment has been increasing at Hanover, but a variety of factors are involved. Style categories have changed in a way that allows for automation. Automation, in turn, has allowed for higher volume production at lower cost, which means greater competitiveness and more orders to fill. In combination, these factors have expanded production, requiring a larger work force.

Among production workers, there have been subtle shifts in the number of people across job classifications. Hanover's production workers are categorized into job grades one through nine, with one being the least skilled, lowest paid, and newest worker, and nine being the most skilled, highest paid and oldest worker. Although the number of job classifications have not changed, i.e. automation has not resulted in the collapse of various job skills into fewer job categories, the number of workers within each category has shifted. The plant manager and the personnel manager agree that with automation fewer people are required in the middle range job grades and more are required in the higher- and lower-skill categories, though they admit that the shift is slight. Employment data (TABLE 1) for the last three years indicate how subtle that shift has been.

TABLE 1

PERCENT OF EMPLOYMENT ACROSS JOB GRADES
1985-1987

	March 30, 1985	March 30, 1986	March 30, 1987
Grades 7-9	8.7%	8.5%	8.7%
Grades 4-6	67.8%	69.1%	66.9%
Grades 1-3	23.6%	22.2%	24.4%

Nonetheless, the middle ranges still represent the bulk of the production workers, with job grades four and five accounting for more than half of all production workers.

Another internal shift of workers due to automation has been in the gradual elimination of the finishing room. Once the most labor-intensive area of the plant, now only 15 percent of the original work force is still there. The rest have been retrained and are working in other areas. When talking about Hanover's newest and most successful furniture line to date, the general manager says, "When it comes off the machine lines and fabrication, it's finished. All we have to do is put it together, compared to where we used to put it together and then run it through as many as sixty people on a glaze line doing nothing but just working the glaze. That didn't include spraying the lacquer and doing all the other [finishing tasks.]"

The displacement of labor due to automation can be a big problem for some companies, according to the general manager. "It has not been here. I'd like to believe that a lot of that is due to good communication with our people, to try to get them to understand that *all* our job security depends on our ability to change." More than good communication, Hanover's ability to maintain and even increase its work force is due to its corresponding market success, which has allowed for the creation of jobs for displaced workers to fill. For example, the new Japanese router did not replace a function, it merely added one. Yet the general manger estimates "that the router would easily do the work of seven pin routers, if productivity were the only measure. However" he adds, "pin routers are not capable of the accuracy and reliability that can be obtained with the new CNC routers and thus were not a viable alternative."

When discussing the introduction of automated equipment on the floor, three separate people at the plant mentioned "Billy," an operator of a manual boring machine that was replaced by a large, very sophisticated, automated drilling and doweling machine. "Billy, who had been here as long as I can remember," recounts the general manager, "could not comprehend the CNC application, and we had to find him another job." Billy is now working as a boring machine operator on a multiple spindle boring machine that utilizes a manual set-up, which is according the plant manager, "much simpler." The plant manager, too, seemed discouraged about Billy and his inability to adapt. A similar situation occurred with the supervisor on Billy's line. The addition of the new equipment "pushed him past the limit of his capabilities" according to the plant manager, and he, too, was reassigned. But such incidents have been infrequent at Hanover, and when they do occur, the worker involved is always given the opportunity to be retrained for another job.

In 1978, the plant initiated a seniority system, which gives the most senior worker in a given job grade first shot at any opening in the grade above, provided the worker wants the job and is capable of performing it. When asked if women, who comprise fifty-one percent of the production work force, are evenly distributed across job grades, the personnel manager quickly responded, "definitely." But upon examining the actual figures, he found that women account for only 27 percent of grades 8 and 9, 26 percent of grades 6 and 7, 54 percent of grade 5, 64 percent of grade 4, 62 percent of grade 3, 58 percent of grade 2 and 27 percent of grade 1.

"I don't know why there aren't as many [women] at the higher job grade," responds the personnel manager. "The seniority system is very fair. If they've got the seniority and they have worked their way up to grade 6, they have the same chance as anybody else to take [a job opening]." His possible explanations of why women were not taking the higher skilled positions as they become available were that women do not acquire seniority because they often choose to return home to their families and that they were less comfortable with the automated equipment.

Blacks comprise about 47 percent of the production work force, about double the proportion in the county as a whole, and they are evenly distributed across job grades. Of the black production workers, 57 percent are women. The personnel manager reports that Hanover has a formal, and successful, affirmative action program. "We had an EEO (Equal Employment Opportunity) audit last January by the state and we came out fine. There were some suggestions, but no violations."

The suggestions undoubtedly involve the area of management, which remains predominantly white and male. All of top management personnel are white men; one of the eighteen staff supervisors is a white woman, the remainder white men. Of the thirty-six production supervisors, six are black men and one is a white woman. Of the fourteen "professionals," mainly engineers, draftspersons, and data processors, one is an asian man and two are white women.

Another personnel policy that affects production workers' abilities to adapt to technological changes in the work place is the company's use of a labor reserve pool. Production personnel are hired at the plant through the state employment security commission. Once hired, they have part-time status, working eight hour days but not forty hour weeks, and balancing daily employment requirements at the plant. This period is designed to give participants experience in several different areas of production. Participants move to full time status when plant payroll requires it, at which time they can bid for posted jobs.

One reason for this pool is to prepare workers to perform a variety of tasks and to make them comfortable with changing tasks, so that when new machines are introduced they will be responsive to and accepting of the change. "Hanover apparently does a good job of keeping its people highly motivated," says the director of the high school vocational education program. "On an assembly line you do one job and that's all. A lot of [workers] don't understand the total process, how they've contributed. [Hanover] seems to be doing a good job" of making people aware of their contributions to the whole production process.

For the operators of the automated equipment, skill requirements vary. In the case of the two saws, both operators agree that the new Italian saw is much easier to operate--it requires very little from its operator--when it runs as it should. But when something goes wrong, the operator is generally unable to troubleshoot. In effect, the operator's task is limited to *monitoring*, rather than operating, the machine.

With the American saw, on the other hand, the operator appears to have more control over the machine, if only by virtue of the greater number of controls available to the operator and access to the computer itself (access which is unavailable to the operator of the Italian saw.) Also, training on the American saw takes six weeks--two hours to learn the control panel and six weeks to learn the computer, according to the operator. The operator adds that it actually takes a year of practice to really understand all there is to know about the computer controlling the saw. The Italian saw, on the other hand, requires only two

weeks of training. The Italian saw operator is required, however, to know how to operate the American saw as well (although the reverse is not true.)

The difficulty with the Italian saw goes beyond the line operator; even engineering is unable to get at the computer. "Today, we can only go [as far as] the computer. We can't get through the programmable controller and what not and [we don't] have all the equipment to debug it,' says the general manager. As a result, an engineer is being sent to the saw's manufacturer in Italy for a week's training to become the resident expert on the inner workings of the computer, so that when down time does occur, someone is on site who can address the problem. Whether or not the operator's job will be upgraded as more is known about the saw remains to be seen, though undoubtedly the engineer will be sharing--either formally or informally--his knowledge of the saw with its operator.

The operator of the computer controlled Japanese router appears very happy with his job and his new machine introduced last year. He did indicate, however, that some workers were unable to adapt to the changing technologies, and that they found the Japanese router particularly difficult. But he likes his machine, and he plays an active part in troubleshooting problems when they arise--mainly due to the extensive diagnostic capabilities of the machine. "It tells you what's wrong, and," he adds, "how to fix it."

The number of engineers and maintenance staff has increased as a result of the investments in automated technologies. These increases, though small, are a direct result of the increased automation on the shop floor. According to the plant manager, the biggest human resource problem associated with automation has been maintenance, and in particular, the increasing skills required to maintain automated equipment. "A first class electrician of fifteen years ago is now unable to handle the maintenance issues today." And he adds, "Some have been able to keep pace with the changes and others not." As a result, Hanover Industries is involved in a Maintenance Apprenticeship program with a community college located in the nearby metro area

When asked about changes in management style or even in the organization of work--changes which often accompany automation--the management of Hanover Industries responds that management itself does not change, but that different skills are required from management personnel. "You need more technically competent people in management than you used to, and you need a wider diversification of skills," says the general manager. "But as far as how you manage an operation, that's no different than when I came to the

company in 1955. People are still people, and any time you make them a number instead of a human being you're headed for trouble."

But some things have changed. In 1984, the company embraced the management program called Phillip Crosby Quality Management, modelled after Japanese-style quality improvement programs, and requiring over $200,000 worth of "schooling" for top management. Although the general manager says that the adoption of the quality management program is not directly related to automation, the main theme of the program is "Do It Right the First Time." With the increasing sophistication of production equipment and the corresponding increases in the cost of the new technologies and higher costs associated with errors, doing it right the first time becomes more essential.

But just as production workers are not involved in choosing the new equipment that ultimately affect them, they are not, for the most part, involved in the organizational quality improvement structure. According to the manager of production engineering, and member of one of the three Quality Improvement Teams (QIT), only one production worker is on a QIT. However, getting more employee involvement is a current objective. At present, production workers participate in the quality improvement process through the filing of an Error, Cause, Removal (ECR) report. According to the company's literature describing the 14-step quality improvement process, an ECR gives "to individual employees a method of communicating to management those things that prevent them from doing their job right the first time." No incentives or rewards exist for a production employee participating in this process, nor does anonymity. Instead, recognition is a significant part of the quality management process with three to eight employees gaining special recognition each quarter and three of them receiving a substantial award annually. According to the general manager, the quality improvement process has not resulted in any type of structural changes in the organization at the plant.

Training

The personnel manager points out how young the production work force generally is and that they are more accustomed to and familiar with computers and therefore more able to adapt to the changes on the shop floor. However, the introduction of new equipment has not always been easy at Hanover. When introducing new equipment, "we do a tremendous amount of crew meetings so everyone [will] know what's going on," according to the general manager.

Training has become a much more important issue as the plant has become more automated. Just as Hanover has had to increase its engineering and maintenance staff to support the equipment, it has also had to improve its in-house training capabilities to support its workers. Now, most training on new equipment comes from either the vendor of that equipment or from Hanover's engineering staff.

During the initial introduction of computer controlled machines in the early 1980s, Hanover had to go outside the company--to the local high school--for more basic education for its workers. In one instance, a high school math teacher came to the plant during work hours and taught geometry to workers on the routers (before the new Japanese router.) In another instance, the vocational program at the school designed a special short course to teach Hanover workers how to read calibrated equipment.

According to the personnel manager, "We have not done that [type of training] for the last two years...Our ability to train in house has got sophisticated enough that...there hasn't been a crying need for that kind of education. That was done more at the beginning to kind of get started."

Nevertheless, Hanover has a very strong relationship with the vocational educational program at the high school. Not only does Hanover annually employee about 30-40 of the average 150 high school graduates--most of whom have had voc-ed courses--but the history of the vocational program and much of its curriculum development has been tied to the presence of and labor requirements at Hanover Industries.

In 1974, the year Hanover Industries began operations, Lee County built its new high school and began to improve its vocational education program. According to the director of the vocational program, one of the reasons that Hanover came to the county was because the county was building a new school and significantly expanding its vocational program. Now, a vast majority of the the high school students--about 80 percent--are vocational completers, i.e. they complete a course of study in one of the eleven vocational paths offered, and up to 90 percent of all students take at least one vocational course during their high school years. The Vice-principal of the high school confirmed the high rate of vocational completers, but added that the 80 percent was misleading since many of the completers are also "academic" students on college preparatory paths.

Because of the dominance of the vocational program, job training is the major focus of the county high school. "We try to emphasize in our guidance program that it's alright

not to go to college," says the director of the voc-ed program. "There is nothing wrong with that. Chances are you'll make more money if you don't, especially if you go into the highly technical fields."

Between 40 percent and 50 percent of the students are now continuing their education beyond high school and more than half of those are enrolling in one and two year special training programs, intended to equip them for higher paying jobs. In addition, the type of job training emphasized in the vocational program directly reflects the local economy and local occupational mix, and local employers, including Hanover Industries, generally rave about the quality of the graduates they hire.

Formal and effective communication channels exist between the vocational program and local industry. The General Vocational Advisory Committee, headed by the director of the vocational program, is composed of members from the local business community, including the personnel manager at Hanover Industries. The committee annually submits recommendations to the school board, and according to the director of the vocational program, "We listen to them, too. Some [of the recommendations] have really changed our curricula."

One of the big curriculum developments involved the drafting program. The advisory committee recommended that the vocational program introduce computer-aided drafted (CAD) into the classroom. At present, the program has four CAD work stations using the same equipment and software as Hanover Industries. Through a cooperative education program that gives senior voc-ed students work experience, a CAD student did all his computer work last year at Hanover Industries. Such cooperation will continue this year as students work at Hanover for six week intervals, with the first student to complete his or her six weeks training the next student, and so on through the school year.

According to the manager at Hanover who supervised the CAD student, Hanover has had "tremendous employees from the high school...really top notch people. They have their work experience with us and make themselves absolutely essential [to the operations at the plant]. They graduate and we hire, if there's an opening, someone who's already trained and familiar with the plant. This high school co-op program has been a really great thing for us."

Many of the high school graduates hired by Hanover Industries are completers of the agricultural machinery maintenance program "because," says the director of the voc-ed

program, "[those students] have a lot of experience in general shop. They are well trained in safety procedures, [and] they have worked together as a team member, lending itself to what they do on the assembly lines."

Besides the introduction of CAD, other recommendations of the General Vocational Advisory Committee have resulted in technological changes at the school. In agricultural maintenance there has been a switch to air-driven, power screwdrivers because Hanover uses them on its assembly lines. In automotive mechanics, a computerized engine analyzer has been introduced because the advisory committee said it was essential. In the area of electronics, industry has urged the school to begin a two-step investment of $10,000 each in digital equipment.

But most importantly, the advisory committee has helped the vocational director and school board to make the most effective investment decisions when it comes to new equipment. According to the director, the advisory committee has helped the vocational program to remain current with the state of the art, advising which classroom equipment to discard, which to continue using, and which new equipment to buy. The director explains -state-of-the-art as not having to have the latest model to be current.

In addition to training production and maintenance workers at Hanover, the high school provides special classes for clerical personnel in various software packages for personal computers, such as spreadsheet and word processing programs. The high school charges Hanover $25 per course, which includes about 20 hours of instruction. Hanover also has a policy of reimbursing employees who take college level courses, if those courses have some bearing on employees' present or future jobs. About 25-30 people took courses last year for which they were reimbursed by the company, according to the personnel manager at Hanover.

The general manager at Hanover Industries talks of the quality of human resources as the major contribution he expects from a community "Our prime worry is the attitude of our people, and the productivity of our people, and that has been exceptional [in this community.]" Such success is related to the receptiveness of the school board and the vocational director to Hanover's concerns.

"We talk with Hanover and find out what skills they feel they need," says the director. "They have been looking for a "general" completer--someone who's experienced working in a lab, working in groups, well exposed to safety, with some general knowledge

of power equipment and hand tools, knows the identification of tools, and with, what we call, a good work ethic...Leadership training is a component of all our vocational programs [and it] complements skills training."

When asked if he has had to make curriculum changes to produce this general completer, the director responds, "We haven't changed our program to create a more flexible worker. Instead we built a program around what industry wants. And in this area, flexibility has been an issue all the time. Industry around here doesn't need a lot of commercial electricians. Rather they need workers with knowledge of basic electronics, so that's the route we went. It just so happens that that is the trend that is happening nationally. We are on the cutting edge because we weren't trapped in traditional [voc-ed] programs originally."

To deal with the problem of maintenance workers, and the increasing skill requirements of their jobs due to automation, Hanover Industries has gone beyond the high school to the nearby community college, located in the adjacent metropolitan area. Staff at the community college, in conjunction with a state apprenticeship coordinator, worked with personnel and production staff at Hanover in designing a course of study for the two employees enrolled in a Maintenance Apprenticeship Program. The program began last year and will take a total of four years to complete, with the two employees taking classes, one or two a semester, outside of work hours. One of the apprentices is more mechanically inclined, the other more electrically inclined, and they will specialize according to those skills. The two are taking courses that are part of the community college's existing curriculum; none of the courses are new or specifically designed for Hanover's needs. According to the community colleges apprenticeship coordinator, Hanover represent a very small part of the program. "We have some industries (from the metro area) with 100-150 people in fifteen different training areas."

The Maintenance Apprenticeship Program is part of the federal Apprenticeship Program. The state Department of Labor and Industry registers the curriculum for journeyman certification. At present, the state is paying 100 percent of the training cost, with Hanover covering the cost of books and other expenses not covered by the state. That level of support is not guaranteed, however, throughout the life of the program, according to the personnel manager at Hanover. State funding "could be considerably less than that by the end of next year, maybe 60-65 percent." The state coordinator explains that funding is dependent upon annual state appropriations, so the amount of funding is never certain, although the program itself is guaranteed.

The personnel manager at Hanover also serves as a member of the local Job Placement Advisory Council, which was originally organized by the county's Board of Supervisors. The Council, made up of local business persons and chaired by the director of the vocational education program, monitors county work force statistics -- labor force characteristics, jobs and their availability, etc. -- on a monthly basis.

According to the personnel manager, the council provides an effective mechanism linking employers with the community and with potential employees. "The Private Industry Council (PIC)[1] is very successful in Lee County. One of the reasons is because of the Job Placement Advisory Council--a format where the person heading YDS is able to come into the community and be invited into the group, fitting right in with the community businesses and influential people. We can tell her (the director of YDS) what we don't like and what we need and she can tell us what's available."

But the program director at YDS has a different view. The Advisory Council "has all the good intentions in the world," she says, but JTPA clients are not being placed. "I don't know what the problem is, why Hanover hired only three or four of my people last year." When you look at the figures, "it looks bad for Hanover, our major employer" she says. According to the Hanover's personnel manager, a total of about 160 people have been hired within the last year, only three or four from JTPA.

Other county employers have been more effective than Hanover in hiring the county's poor and unemployed, but the placement problem remains. There is a new fast food franchise opening in Lee County, and, according to the director of YDS, it is hiring people from the nearby metropolitan area.

Hanover's policy of using the state Employment Security Commission (ESC) to hire its production people is the major stumbling block, according to the director of YDS. Applicants have to travel about 25 miles to the adjacent metropolitan area, where the ESC office is located. Since many JTPA clients are without cars, and there is no bus or taxi service to the city, it is very difficult for persons even to fill out an application.

The director of YDS has repeatedly asked Hanover for permission to screen applications at the YDS offices, located about a mile from the Hanover plant, but to no avail. JTPA would provide on the job training and subsidize half the cost to Hanover.

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[1]The PIC receives Job Training Partnership Act funds, which are administered in Lee County by an organization called YDS.

"We have an open contract of $5000 with Hanover. We have the money, why not use it?" says the YDS director.

Because of the availability of this training component, the director of YDS does not believe that the automation at the plant is an obstacle to hiring JTPA clients. Hanover's personnel manager "tells me he's going to start trying to do better [in hiring JTPA clients]," she says, "but he's been saying that all along."

For those few JTPA clients who have been hired, the vocational program has worked with Hanover in training them for work at the plant--some receiving training in word processing and business computer applications, some being trained in general shop floor procedures.

The Local Economy

As Hanover Industries continues to increase its employment, competition among local employers for qualified workers is also increasing. According to the president of Apple Apparel, the second largest employer in Lee County with approximately 600 people, it is "becoming more difficult to find good workers" because Hanover has the first pick, paying the highest wages (about $1 more per hour than Apple) and employing the greatest number.

Apple Apparel, which has been in Lee for 36 years, originally sold the land to Hanover Industries in 1974, with an understanding that Hanover Industries would employ mostly men, which would balance the predominance of female apparel jobs in the county. Now, not only has overall employment increased, the percent of women at Hanover has also increased, cutting into the apparel firms' labor supply. Nevertheless, says the president of Apple Apparel, "We've managed to live together."

Although Hanover Industries does purchase supplies and services locally, the transactions generally are not related to the new, automated equipment. Rather, as mentioned earlier, Hanover Industries purchases locally supplies from the hardware, office supply, and auto parts stores.

According to the MRP manager at the plant who is in charge of production and inventory control, purchasing, and sales and customer service, "The sophistication of the equipment that we use requires that we go further outside the local area for special needs...People to service the modem and office computers are an hour and a half away, so

that's frustrating sometimes...We have to choose the more reliable manufacturer over the less expensive from a service standpoint of being out here in the sticks--'cause we are in the sticks."

Much of the equipment is serviced by vendors, and that, too, often poses a problem when the vendor is a foreign company. Hanover recently purchased a highly specialized piece of equipment designed specifically for them from a Spanish company. When the machine was completed, the Spanish firm delivered the piece along with a technician to train engineers and operators at the Lee County plant. The technician spoke no English--in a county where less than one percent of the population is of Spanish origin. Hanover hired a Spanish instructor from the local community college to act as interpreter; however the technical jargon involved was close to beyond the capacity of the community college instructor's abilities. "It was a zoo for two weeks," according to the MRP Manager.

Because personal computer (PC) capacity has increased so significantly over the last five years, Hanover Industries is now able to do in-house tasks that used to be contracted out. For example, Hanover used to contract with a New Jersey company that developed a software package that optimizes the utilization of sheets of wood by determining which patterns the saws should cut. Hanover and the New Jersey company were connected by an old Western Union tele-type, with Hanover sending the production problems up, and New Jersey delivering the answers down. Now the software is on diskette, and the PCs at Hanover are "optimizing all day long to support the cutting of the saws," says the MRP manager. "The PC in turn generates computer instructions...[for] the computers at the saws to tell the saws what to do." Instructions, in the form of computer tapes, are hand delivered to the saws for programming.

Although Hanover Industries was characterized as being located "in the sticks," its location provides access to the kind of resources that are making the world smaller everyday. Proximity to a metropolitan area, access to overnight delivery services, and access to a commercial airport are all important factors that made it possible for Hanover to pursue its automation plans, according to the general manager.

Management at Hanover Industries seems committed to the small town quality of life, and contributing to it. "We feel responsible for things like supporting schools," says the general manager. "We bring coop students in here, we buy band uniforms to help the community. We donated to the high school IBM equipment in order to promote the internal growth of our students here. We draw on the schools to support our operations; even if

students don't come here you need to do that kind of thing...I think that's the part we have to play."

"We 're really trying to achieve something here, " says the MRP manager. Maybe it comes from being the big fish in the small pond."

Lessons from Hanover Industries

This case study of Hanover Industries represents only one story among thousands of U.S. manufacturers' attempts to remain competitive through technological advances. And it illustrates how those advances can dramatically alter both the product and process of traditional manufacturing, in this case the manufacture of furniture.

Although a distinct situation, certain characteristics and lessons from Hanover Industries' experience should be highlighted. Most notably, Hanover is a healthy, profitable division with the resources to make investments in automation. With the exception of education and training, Hanover has not used public resources in making its investment in new technologies; instead it relies on its own expertise and capital from the corporation. Furthermore, it has used new technology to increase capacity and output and to introduce new product lines, which have allowed for corresponding increases in employment. Although an automated machine may do the work of several people, the machines in this case are providing a competitive edge that allows for expanding operations.

This case study also illustrates some of the needs unique to rural manufacturers. At Hanover, both technical and training expertise have had to be developed on-site to deal with the growing sophistication of the equipment and the increasing skill requirements of employees This on-site development of expertise is in part due the unavailability of such expertise locally.

Associated with this change are changes in staffing patterns, with a subtle polarization of skills among production workers, an increasing need for greater skills among maintenance workers, and a greater need for engineering support staff. Also, as the U.S. labor force as a whole is projected to become increasingly more female and even more minority over the next fifteen years, it becomes increasingly important to train minorities

and women in engineering and managerial skills, fields where they remain disproportionately under-represented.

As the largest employer in Lee County, able to draw on a six-county area for labor supply, Hanover has been able to pick the most trained and trainable workers for its plant and it has greatly influenced the training local students receive at the county's high school. From a local economic development standpoint, the county is quite dependent on a single employer. And although the plant brings aggregate benefit to the area in terms of payroll, taxes, and charitable contributions, many local people, particularly the poor and the long term unemployed, are excluded from the benefits of this type of development. Other, more community-based, economic development strategies must be advanced locally to address these needs. (Though in this community, with its lack of local leadership, any type of planned economic development may be unrealistic.)

Another characteristic of this case study that should be highlighted focuses on access--to interstate and four-lane highways, airports, overnight express services, and telecommunications networks. Automated manufacturers in rural areas consider these locational features vital to their operations and their ability to automate, and these features can offset hindrances associated with being "in the sticks."

All of the issues raised above can be addressed by state and local policy makers. Education and training, technological infrastructure, and economic development planning are public responsibilities that can enhance rural manufacturers' ability to successfully modernize their production process, their product, and their work force.

CASE STUDY III

A DECISION FROM THE HEART: *MIDSOUTH ELECTRICS COMPANY*

by Stuart A. Rosenfeld

Introduction

Annville, Kentucky is not the kind of place that's supposed to attract manufacturing firms that use advanced technologies and require a skilled work force. At least that's what the literature on plant locations tells us. The village, of at most 300 people in a county of about 12,400, is tucked between the twin federal reserves of the Daniel Boone National Forest in Jackson County in the foothills of the Cumberland mountains of southeastern Kentucky. The entire county has but one incorporated town and not a single in-door movie theatre, shopping center, MacDonalds, Wal-Mart, hospital, college, television or radio station, or tavern. The nearest interstate highway exit is about 25 miles away, at London, and the nearest commercial airport is 80 miles north, in Lexington.

Conventional statistics paint a bleak picture of life in Jackson county. It is one of the state's most rural and poorest counties. Earlier this year, a researcher at the University of Kentucky ranked Jackson dead last among the state's counties on a scale devised to measure "quality of life." The low ranking was a result of the county having the lowest rate in the state of its adults completing eighth grade (62%) or high school (25%); a per capita income in 1983 of $4,779 that was just 41 percent of the national mean; average manufacturing wages of $176 per week in 1983, which was 38 percent of the national average; and a reported unemployment rate of 16.5 percent at the end of 1985 but a real unemployment rate -- which includes those no longer getting unemployment benefits and/or discouraged from looking for work -- that is probably closer to 30 percent. According to the 1980 census, there were only three doctors and only one dentist in the county.

Annville is the very same village, however, that was selected for the location of a new multi-million dollar manufacturing facility this year. The plant eventually will employ about 500 people to produce high-tech components for consumer electronics using some of the most advanced production equipment available. In 1985, Mid-South Industries, Inc., with headquarters in Gadsden, Alabama, announced that it would invest in a new plant in Annville, Kentucky.

Why did Mid-South choose Annville, when it seems that according to most accepted location criteria that there would be many more economically attractive sites? The site lacks most of the factors that experts tell us are important to high-tech manufacturing expansion decisions -- high quality education, a highly educated work force, and proximity to metro areas, universities, and airports. And what will this new plant do for and to the community, county, and state?

Two years ago the Southern Growth Policies Board documented the slowing growth, and in many cases declines, of the economies of large numbers of rural counties in the South. Policy makers were warned of the poor prospects for growth in manufacturing, which has been the mainstay of the region's rural economy. Lower labor costs in foreign countries were luring away the South's jobs. Technology, the Board hypothesized, holds the key to revitalizing rural manufacturing. Through the Board, the Southern Technology Council applied for and was awarded a grant to investigate the impact of technology of manufacturing in rural areas in an attempt to discover how government policies might more effectively facilitate and support modernization.

The School from Which a Town Grew

The story of Mid-South's decision to locate actually goes back to 1909, when the Dutch Reformed Church settled on Annville as the site for its offices and a school, the Annville Institute. The county was first settled about four decades earlier, during the Civil War, by northern sympathizers from east Tennessee who were escaping service in the Confederate army. According to early county histories, Jackson was 100 percent with the Union. The early settlers were seeking a place to make a life for themselves, not wealth. The economy was mostly agriculture and mining, and most youth followed their parents' footsteps into the farms or mines, if they were boys, or into early marriage, if they were girls. And people wanted to stay, despite lack of economic opportunities -- some because they had nowhere to go and some by choice. (Many did leave, however, for opportunities in the industrial north.) One progeny of an early settler said "this place is so significant, with a real sense of place and ownership. Even our dialect is beautiful."

The multi-building campus of the Institute, which is now the headquarters of the Jackson County Ministries and has not been a school since 1978, still dominates the town. The imposing white frame building set back from the road anchors the village at one end, replacing the school, courthouse, or church as the dominant edifice. The entrance to the new Mid-South plant reminds visitors of the legacy of the Institute. The wall of the new

circular reception area of the modern plant is lined with pictures of early graduating classes and watchful portraits of past principals -- Mr. and Mrs. Worthington and "Mother" Worthington -- as if to make sure everyone is shaping up.

Schooling, however, was a low priority for most families in this poor, rural, and agricultural part of the state. According to long-time resident Dorothy Brockman, "Our people are satisfied without going to college...They've been brought up this way. Everyone doesn't see the value of a good education." Many of those who did want a more complete education chose to attend the Annville Institute. Throughout much of its history, it was the only school in the county and as a private boarding school drew students from surrounding counties as well. The school's curriculum included the arts and academics as well as occupational skills.

The philosophy of the Institute was similar to that of Berea College, which is only about an hour away -- combining work and study. Although the school charged tuition, students worked for their expenses, and wealth was never a criterion for admission. "No one," according to Ministries Executive Coordinator Paul Aldrink, "was turned away for lack of money." In fact everyone was expected to contribute to the operation of the school, either running the Institute's working farm, doing local crafts, working in the kitchen, or doing general upkeep. At its peak, enrollment was about 500, recalls former teacher Dorothy Brockman. It had an active alumni association that kept track of former graduates.

Residents attribute the decline of the school, beginning in the late sixties, to its growing redirection as a place to educate problem youth rather than just to get a high quality education. There was some talk at the time of the school becoming a vocational school, but the financial base to implement such a change was not there and the school closed its doors.

Back in the heyday of the school, in the late 1940s, Chairman of the Board of Mid-South Industries, Inc. Jerry Weaver and his brother, John, who were from neighboring Clay County, graduated from the Annville Institute. Jerry Weaver's gratitude and loyalty to the school, even after it had long since closed its doors to students, endured. A desire to do something for the community undoubtedly influenced his decision to locate the plant in Annville. According to Mid-South Project Manager Elmer Green, "Very seldom do I hear Jerry Weaver speak without him going back to his early years on the campus of Annville.

He looks at that as his formative years of his life and values the training and standards he received."[1]

School ties alone, however, would not have been enough to make a multi-million dolllar investment decision. Jerry Weaver is a successful Alabama businessman and would not have made an economic decision on the sole basis of emotional ties. Annville and Jackson County also had to possess the potential to support the manufacturing operation at a competitive cost. In accepting the county's proposal, Weaver wrote "As you are aware, I have deep roots in both Clay and Jackson Counties and for this reason I did not feel that I could be completely objective in making the plant site decision, therefore, Mid-South engaged J.D. Thompson, Inc., a facility specialist, to perform the site selection analysis. Three consultants, working independently of each other, surveyed both the Clay and Jackson County proposals. Our selection of Jackson was based, in part at least, on this study."

The Place and the People: Jackson County, 1987

For a county that ranks at the bottom on most measures of well-being, the county gives all appearances of being surprisingly well-off. The homes visible from the main state and county roads are well-maintained and don't look very different from more prosperous rural areas. There is a sense not of resignation or discouragement but of dignity and pride. Citizens of Annville and McKee, the county seat, are incensed in general about the nation's view of their plight and in particular about the county rating they were given by the researcher Dennis Quillen from the University of Kentucky. A Jackson County social worker, Pat Wagner, told a *Jackson Sun* reporter, "I was thinking this morning how going away and living in a big city where the 'culture' is is not what's it's cracked up to be. You can't just use numbers and statistics to talk about the quality of life. Just to take a walk and feel safe is important. There's a lot to be said for knowing neighbors you can trust. Formal education is not all there is." Engineer Mac C. Moore went even further, claiming that " [I] could take my own set of questions and prove that Jackson County is Utopia."[2] State Senator, Gene Huff, who came to Annville along with U.S. Congressman Hal Rogers to break the ground for the new plant, echoed the local responses. "I didn't want to come [to the ceremony] mad. Whoever wrote that article didn't eat at Alfred Green's table

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[1] *Jackson Sun*, 61 (May 23, 1985).
[2] *Jackson Sun*, 62 (November 28, 1985).

in Jackson County. People here are a special breed -- committed to their homes, communities, church, and work."

As with many rural towns, Annville is a friendly community where everyone knows everyone else. The single restaurant in town caters to the new Mid-South management and workers, and in the few short months since the plant management began to move in, the jovial relationship among the new and old residents and between the customers and staff has become evident. Family roots are important, and candidates for public office frequently campaign on the basis of their family background and community ties. Religion plays a big part in community life, and the residents ar proud to have churches of five faiths. The Reformed Ministries of America, which continues to occupy the Annville Institute, organizes a volunteer community assistance program for county residents that helps people -- particularly the elderly -- maintain their homes. Last year, over 250 volunteers from all over the United States worked in Jackson County through the Ministries.

Real estate is not expensive, and a new county brochure advertises that the average new home in the county is 51 percent lower than the national average. The county has a sheriff, two deputies, and two city police, but crime rates are low and most of their job is routine.

Before Mid-South came, the economy was heavily dependent upon agriculture -- mostly tobacco. There were only 342 manufacturing jobs in the county in 1984. Except for the biggest, C. M. "Mib" Carpenter's paving and trucking company (97 employees), and a relatively new Laura Ashley apparel firm (58 employees), which residents brag is the company's only remaining plant on-shore, most are small crafts shops. About one-third of the county's work force commutes outside of Jackson county to find work. In 1986, 908 residents commuted out of Jackson county while 218 commuted into the county from other counties.

There are several plausible explanations for the disparity between the statistics and observations of the area. Some of the more extreme poverty may be back off the main roads and not visible to the casual visitor. As Judy Schmitt, local development official explained, "the Annville area and McKee are the most well-off parts of the county. Some citizens admit that there is a great deal of extreme poverty back in the hills, hidden from view -- especially north of Annville, toward the Clay County line." The nice homes and most educated people are located along the major highways, 431, 30, and 290.

Dorothy Brockman attributes the differences between the numbers and observations to the lower costs of living. "People here have gardens and they've owned their homes for quite a while, and that's the biggest expense. People from other states and come here and say 'well, I made more there but I've got more left here' "

Many people, despite the gloomy statistics, still feel that Jackson County has a lot to offer and that you can get as good an education as in any other school system. "It's just a matter of how much you want to apply yourself." Yet the school district ranks near the bottom in the state on retention, losing about 33 percent of its students before graduation. One new Mid-South manager admitted that he lives in London, about 25 miles away, so that his children can attend a better school system.

The county high school has an extensive offering in vocational agriculture, consumer and homemaking education, and business operation with, according to the school counselor, a backlog of students waiting to enroll. Courses available at Jackson include Industrial Communications and Production; Agribusiness; Introduction to Business; Business Law; and Supervision. Vocational agriculture is the school's most attractive program, according to the school counselor. Its students are leaders in the community and among the most respected in the school. Three-fourths are in honor society or rank near the top in the class scholastically. "No program is as consistently good," a school official asserted.

The high school also has an extensive vocational program for learning disabled students. During the past year, the handicapped students built an entire house on the premises, which the school intends to sell.

The county has no area vocational center (AVC), but students wishing to enroll in industrial programs can choose to commute by bus to the Clay County Vocational Center or the Laurel County Vocational Center, where more specialized programs, for example, in trade and industry, and health occupations are available.

The programs at the AVCs ostensibly are more occupationally specific. But it is difficult, under most circumstances, for secondary vocational schools to keep up with technological change, especially in poor areas. The Laurel County Vocational School is in an impressive new building located right behind the county high school, but the machine shop had but one modern computerized numerical control machine. The other 20-30 machines were older, mechanical models, not likely to be purchased or even used any more

by growing manufacturing firms. Further, transportation has become more difficult. In past years, two buses were available to take students to the neighboring vocational centers for more specialized programs. This year, due to budget and space restrictions, there is only one bus available. A school official revealed that 55 Jackson County High School students would like to attend the Clay County Vocational Center in the afternoon, but can't because of lack of transportation.

Some residents ar able to earn a livable income by working part of the year outside of the state. According to Schmitt, people will go up to Connecticut or other parts of the Northeast and "hang drywall for a couple of weeks or until they make enough to live off of and then come back home. They know they can make big money if they move permanently, but that's not what they're after." But of course some do move. A flow of eastern Kentuckians to Norwood, the section of Cinncinati where the large General Motors plant is located, has been going on for years. Many return home after they have saved enough to live on for a while. Then there's the underground economy. Although only nine percent of the labor force still farm for a living and tobacco is the main crop, the growing and harvesting of marijuana, the successor to "Moonshine," is rumored to generate a large number jobs and local income.

Annville is on the verge of incorporating, a concession granted to Mid-South as part of the agreement to locate. At present the village is an unincorporated mile-long string of homes and business establishments along state Highway 30, just barely on the map and without any taxing authority, government, or municipal services.

The Proposal: A Community Effort

In the fall of 1984, Jackson County first began to aggressively pursue economic development by establishing its own Development Association. The catalyst, as in so many rural areas, was the county extension office. The first initiatives were along traditional agricultural extension lines, such as finding ways to use natural resources for tourism and recreation businesses. The Development Association spun off the Jackson County Industrial Authority Board to broaden its focus, and Lewis Ray Norris, Administrative Services Manager of the Rural Electric Community Corporation, Inc. was appointed to chair the new board.

Just a few months after the Association was formed, a fire destroyed much of a Mid-South Industries plant in neighboring Clay County, a plant that employed many

Jackson County residents among its 300 or so employees. With dozens of local workers displaced, a major concern was whether Mid-South would rebuild its Clay County plant and restore the jobs that were lost. The Clay County plant manager told the *Sun* reporter, "we're looking at some cold realities. This is a devastating situation and it does not look real good."

In February 1985, Jackson County first became aware that Mid-South Industries was giving serious consideration to a new, high-tech Mid-South plant somewhere in the area. In May 1985, Jackson County's Development Association called a community meeting to talk over the opportunities afforded by Mid-South's possible new plant. Over 500 people crowded the local Rural Electric Cooperative Corporation, Inc. (RECC) building in McKee to hear Elmer Green describe the four Kentucky counties being considered for the new plant. Chairman Lewis Ray Norris asked the County Development Board whether it was interested in bidding for the plant. The reply, according to Judy Schmitt, was "let's go for it." They county formed a site selection committee, with the mayor of McKee appointing three members and the county judge appointing three members. The committee decided on two site options for Jerry Weaver, CEO of Mid-South, to consider. Still, there seemed to be little hope for Jackson County. According to RECC manager Norris, "When we started dealing with Jerry, I think he felt there was no way that Jackson County can do it and I think we actually surprised not only ourselves but everyone else too. We put together a great package"

The major advantage of Jackson County, according to nearly all involved, was "cheap labor," but also industrious labor, with good work habits. The proposal highlights the fact that "The local work force is comprised of good work ethics and habits. They have a high degree of mechanical aptitude, loyalty, punctuality and low absenteeism. The people are willing to work." The proposal admitted that "The local work force is lacking in the formal educational levels of some areas of the country, but I truly believe that their common sense, inherent mechanical abilities, and self-sufficient habits developed over the years of struggling against odds make them exceptional candidates for employment."

But wages and work ethic in Clay County were not much different from those of other locations, so that was not a sufficient advantage. The industrial development committee began to put together incentives that they hoped would prove irresistible to Mid-South. First, they identified expertise outside the local areas. They contacted the University of Kentucky which sent an industrial development specialist, the state Department of Commerce, which sent a person to help,the East Kentucky Power

Company, and the architectural firm of Chrisman, Woodford, and Miller in Lexington, Kentucky.

Land at a very low cost was one special advantage the county was able to offer. Mib Carpenter offered 16 acres of land along Highway 30 for $60,000, estimated to be less than half the cost of land in Clay County. The development association applied to the state for a Community Development Block Grant and received $400,000. Of the total, half was given to Mid-South as a 15-year, 3 percent loan for equipment and the other half went for local improvements, including water and sewage treatment.

When the chances began to look good for the county, the development committee applied to the Economic Development Administration for a $600,000 grant to expand the site as a future industrial park, and Carpenter sold a total of 104 acres at $600 per acre, which was, according to Lewis Ray Norris, "a steal." In addition, the association put together a comprehensive training package that combined funding from the Bluegrass State Skills Corporation, the Cumberlands Private Industry Council (JTPA), the Eastern Kentucky Concentrated Employment Program (EKCEP), and the vocational schools.

Further, the location for the plant, though rural, was more advantageous than the isolation would lead one to suspect. Eastern Kentucky is in a central location for many large metropolitan and industrial markets. Annville is less than 400 miles from Atlanta, St. Louis, Cinncinati, Louisville, Detroit, Nashville, and Cleveland. And despite the ruralness, it has one-day delivery service via United Parcel Service or Federal Express. Plans are also underway to build an airport in the county with a 4000 foot lighted runway. The Christian Appalachian Project traded the county 50 acres of land suitable for the runway for 50 other acres.

The proposal committee had expected that the architectural consulting firm that had worked with it would prepare the final proposal. About a week before the proposal was due to be submitted, the group realized that the firm was not going to write it, and Judy Schmitt was given the task of writing the final report. Never having written a proposal of this magnitude or potential impact before, she did get some help from the firm and from an economic development specialist from the University of Kentucky. Still, Schmitt worked long hours drafting the report and preparing the graphics and background data. It was written on Apple computers at the local high school, but the final version had to be taken to Lexington for access to a laser printer to get a letter quality copy. Finishing the text on a Sunday, Schmitt worked late into the night putting it together, along with children from the

local church who colored in symbols and diagrams, adding a personal touch to the final proposal.

The county, with a unified and collaborative effort, was able to provide the right set of conditions and incentives. The services that Jackson County obtained through the state of Kentucky, the tax incentives, and the training package were the key elements in Mid-South's decision to locate in Jackson county. These were able to offset a relatively weak educational system and lack of easy access to resources such as management consultants, a university or technical institute, a commercial airport, or the amenities of a metropolitan center, which were considered of less importance.

The Decision to Expand and Automate

Mid-South Industries, Inc. is a holding company founded in 1964 and headquartered in Gadsden, Alabama that provides training services and parts to a growing number of commercial and government markets. Its reputation has been built on quality, price, and on-time delivery. Jerry Weaver, Chairman of the Board, is a hands-on manager who is convinced that American industry can be competitive once again by (1) reducing costs by having people do more things for themselves, (2) improving communications among industry, labor, and government, (3) investing in R&D, (4) investing in long-term capital, and (5) building on its own assets.

The decision to expand was quite straightforward: perceived market opportunities. The corporation had begun to invest in new technologies in its Clay County plant when the fire destroyed the facility two years earlier. The new plant was intended to replace the lost production but also to expand into new electronic products.

The decision to locate in Annville, however, was a decision of both the pocketbook and the heart.

"The ultimate drive was, of course, economic," explained company president Jerry Weaver. "If you can't make the thing go, there's no reason to be there in the first place. But once you get past that, sure, there's a good feeing about being in that area. Coming from that area made me realize the competence -- the people aspect."

The success stories of people who left to find better opportunities left a lasting impression on Weaver. "After World War II, people ended up migrating into the industrial North. At that time they were not very well educated, but they moved into what I call

'middle management' -- group leaders, maintenance workers, tool and die workers -- and seemed to do quite well. We still have the same kind of people with the same heritage. Work ethic is a big part of why I moved back here....People don't want to leave and you have a stable work force. What makes it stable is that they can't quite make a living on the farm but they'd like to stay. Hopefully our employment will allow them to stay on the family farm and still increase their standard of living."

Other areas were considered, but only informally. Jerry Weaver's experience in travelling around the country and his experience as past president of the National Association of Tool and Die Makers, provided all the information he needed. Especially, since Kentucky is where his heart was taking him.

Although labor -- stability, loyalty and low costs -- was obviously a key factor, federal, state, and local funds were packaged to help entice the business to Annville. Just how important were they? According to Mid-South's President and CEO, not very. "When you're spending $10 million and someone gives you a grant to fix up things like a parking lot, that shouldn't be a major reason for making a decision -- and they didn't influence me.

Even the extensive training assistance did not weigh heavily in his decision. "You can get training in any state when you come right down to it. Some present if differently, but basically you can get training money in any state now as well as federal money."

What did influence him though, as indicated in a letter to the county industrial board, was the availability of low-cost suitable land, the prospects of a nearby airport, and easy access to Highway 75."[1] More important, though, was the "climate.": the interest the state and community had in pulling us into the community, the aggressive assistance from the state, and "the cohesiveness of the entire community and total commitment of every citizen.". "The political system was together, the school system was together -- even though they have problems, they were both together on this subject. They'll have a stronger, long-term appreciation of the facility than some communities would. It's their facility and I like for people to think that even though I might own it. It's our facility, really."

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[1] *Jackson Sun*, 62 (September 19, 1985).

At present the manufacturing facility is an impressive but stark-looking brick structure on a quiet state highway. Access roads to the plant are still under construction and the landscaping is just getting started. When complete, there will be nothing comparable anywhere in the vicinity. "We will be very high-tech," Mid-South President Jerry Weaver told an audience at the groundbreaking ceremony, "to put us up competitively with the world."[1]

On September 21, 1987, however, the manufacturing operation was still unrealized potential. The production floor of the 100,000 square foot, $10 million facility was just beginning to fill up with equipment, with a few pieces of modern assembly equipment standing out conspicuously, silently waiting to be engaged.

A technician with an associate engineering degree sat at a computerized schedule and dispatch station designing programs and practicing allocating work to empty stations. Nearby a blue parts inventory carousel sat empty. When operational, however, the computer system will allow for a "continuous flow system," which will be able to coordinate the production of multiple solid state devices, shuttling parts and components alternately to appropriate work stations. An automated plastic molding machine and a computerized wave soldering machine also sat idle but ready. But most of the floor was still empty. Company planners expect that between one-half and three-fourths of the production will be automated.

The plant will not be quiet for long, however. When it begins operation in a few months, it will be producing electromechanical assemblies, plastic molded components, and electronic parts for a wide variety of consumer products. Like so many modern manufacturers, the company will rely on just-in-time inventories to remain competitive. Production will be planned to fill orders, not for inventory, and finished parts will go directly to shipping.

The research and development required for manufacturing and the product design are all done at the corporate headquarters in Gadsden, but the process design is done by engineers at the Annville plant. About a dozen engineers and ten technicians with associate degrees will be employed when the plant reaches its planned production levels next year, and most will be hired from outside the company. Getting engineers to come to Jackson

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[1] *Jackson Sun*, 63 (July 23, 1987).

County posed a problem, with some applicants unwilling to relocate to such a rural area. But, as the personnel manager pointed out, it was just a matter of finding the right person. Most of the engineers already hired had ties to the state, either by birth or by marriage to a Kentuckian, although professionals did move to Annville to work with Mid-South from as far away as Oklahoma and Texas. For Ken Smith, who came from suburban Tennessee, it was "a personnel manager's dream, a true opportunity to see some results that are totally new to the area."

Some of the delay between completion of the plans and production was intentional, to give the company the time it needed to educate and train the work force for new kinds of work and new kinds of management. Many of the people selected for training were employed previously at the Mid-South Industries metal stamping and plating plant in the adjoining county that was destroyed by a fire in 1985. Work at the old plant, however, did not require as high levels of skill and education as the work in the new plant will require.

The investments in the new automated equipment and anticipated changes in work have already had a significant impact on the future work force. The trained employees seem ready and anxious to get underway on their new jobs. One new hire asked, "Did you see the automated carousel out there? It took my job. I used to be a material handler. But now I'm going to operate the injection molder." They seemed a little awed by the value of the equipment and the confidence the company placed in them by assigning them to the expensive equipment. One newly trained employee commented that he worked hard to become competent because he was "not about to make a mistake on that kind of expensive machinery and let the company down."

Enthusiasm is high despite relatively low wages for manufacturing. Salaries for most will range from minimum wage to $5.25 per hour, although some more experienced tool and die workers, inspectors, or technicians may earn up to $11 per hour. Expectations are low in a county accustomed to high unemployment and poverty, and just having a stable job in a pleasant, clean environment is a major step forward for many local people. As Steve Zimmer, director of Bluegrass State Skills Corporation, pointed out, "They [the company] are getting workers a lot cheaper than in most locations in this country. But they're taking people with educational levels and skill levels that won't get that pay -- as low as it seems to us -- anywhere else, inside the area or outside."

The nature of work with high-tech equipment is still a source of controversy. While most argue that technology requires higher-level skills, some still maintain that it de-

skills work. According to Mid-South personnel, there's some truth in both. Much of the work may be routine, but when things go wrong, as they inevitably do, workers on high-tech equipment are expected to recognize the problem and the source of trouble immediately. The personnel manager was asked whether experience provides the same skills. "Experience can teach you that a part is coming out wrong, but not why. That's the difference. They have to know the entire process, even if the problem is in somebody's else's operation, and know themselves what to do about it."

Personnel Manager Ken Smith described the kind of person the company was seeking. "We want a knowledgable work force, not the old-type assemblers who put parts together and send them down the line. We want educated people who know what they're putting together and know how it works, to know the names of components, how to check them, people who have a basic understanding of how everything works together. We feel that for us to be competitive it takes a complete team effort. The more knowledgable people are about the product, the higher the quality of the end result. But it also gives them more confidence, they feel more a part of the organization and get more involved."

Plans are being made for quality circles and there is clearly an attitude that the ideas and opinions of the employees are to be valued. Mr. Smith predicted that the real changes will come over time and "will stem from the training, the knowledge of the products, and the people all working together."

One of the cornerstones of Mid-South's high-tech management philosophy is *quality*. With technologically advanced equipment and products, however, quality is not the ability to craft a part expertly. Most of the "crafting" is controlled by computers, and the principal manual requirements of workers is assembly. In an automated work environment, quality is a statistical concept that requires operators to measure product quality precisely and understand why changes occur. The other cornerstone of the high-tech management philosophy is *flexibility*. In traditional manufacturing, workers only needed knowledge to do their own tasks and the movement of parts was controlled by management. At Mid-South, each employee is given more control over the pace of production, the knowledge of the entire operation, and multiple skills to allow them to transfer among work stations.

Education and Training for High-Tech Work

According to the director of the Mid-South training institute in Gadsden, Dennis Phillips, "the minimum requirement for consideration of employment, if we are going to compete internationally, is quality literacy and manufacturing literacy." In a county where only one out of four adults have completed high school, however, that means a major investment in education and training. The decision to locate in Annville was predicated on the strongly held conviction that the local work force did indeed have the potential to be educated and trained to operate and understand advanced manufacturing technologies despite its low average levels of educational attainment. As the personnel manager said, "we knew the capabilities of the work force. People are honest and dependable and given the opportunity and the training, we felt we could run a high-tech facility here."

Mid-South Industries is a company that seems to understand the importance of education and training. The company owns and operates the Academy of Precision Arts in Gadsden, Alabama, which provides a continual supply of skilled workers in addition to training for other firms. It also has a college tuition program whereby employees are reimbursed for the costs of postsecondary education.

Mid-South personnel, prospective trainers, and local officials traveled to Mid-South's training center in Gadsden to see the skills center in operation and to learn more about the skills and knowledge that would be needed by the new workers at the Annville plant. The travel expenses of seven people were paid for through the "train-the-trainer" program of the Bluegrass State Skills Corporation. It was an experience that greatly impressed upon the visitors what could be accomplished and what had to be done. According to RECC manager and Industrial Authority Chairman Lewis Ray Norris, "they [Mid-South] have what I consider to be the finest training center that I was ever in. It's just outstanding." A state official admitted that it was far better than almost any vocational education facility in Kentucky.

A fine training center nearly 300 miles away, however, is of limited value to rural Kentucky. Therefore, the company decided to open a new training facility right in Annville. And not surprisingly, the site selected was the old Annville Institute, now the home of the Jackson County Ministries. Even before the first brick was laid for the plant, education and training programs got underway at the Institute.

The first people invited to participate in the training program were those who had lost their jobs at the Clay County Mid-South plant when a fire destroyed the plant in 1985. Most had been low-skill assemblers, metal stampers, and material handlers and had dropped out of school well before high school graduation. Yet the company had faith in their ability to learn, to acquire a sufficient level of basic skills to be trained for the modern work place.

The company contracted with the Jackson County Ministries to rent space for the training program in the Annville Institute. A class of 20 students, selected after extensive testing, went through a 30-day intensive program called Principles of Manufacturing. The curriculum included basic math, blueprint reading, measurement and instrumentation, and statistical process control. Next, 40 people were selected from among 200 more applicants (based on test results) for an even more intensive program that added flexibility to operate all of the plant's equipment. The main criterion for selection for this group was the ability to read and compute at or near the eighth grade level. Thus, the group was slightly better educated than the average displaced worker in the county. Of the 40 participants, 22 had graduated from high school and 17 had dropped out.

The training site, the Annville Institute, is a group of beautiful frame buildings. Most of the training area was in the basement, although the GED classes were held upstairs in an old school classroom. The basement classroom was set up in traditional fashion, with a blackboard at one end and standard student desks in rows facing the board. As grey and spartan as the atmosphere was, it apparently began as just a musty cellar. The Institute cleaned it thoroughly and made it presentable -- and rentable.

An old injection molding machine was set up in another room and a large open area provided space for the hands-on instruction with electronic equipment. The strength of the education, however, was not the physical resources but the quality of the staff and instructional materials. Students were grateful for the opportunity to get the skills they needed but knew they did not have and to be in a supportive environment where all the students were in similar situations.

The instructional period was a full 40 hours per week and lasted for six months, and near-perfect attendance was expected. Special arrangements were made to accommodate people who had jobs and needed to attend in late afternoon and evenings.

Funding for the program came from a variety of sources, but the key to getting full-time attendance for a half year was a $3 per hour stipend from the Job Training Partnership Act. That and, of course, the guarantee of work for those who completed the program successfully. Stipends are prohibited by JTPA, but the East Kentucky Concentrated Employment Program (EKCEP),which administers Title II of the program, is one of four poor and geographically isolated CEPs in the nation that retain the right to continue the stipends that were authorized under CETA. The grant paid the students (at least those who were willing to give up $30 per week welfare for a $3 per hour stipend), paid the salaries of the trainers, and purchased some supplies and equipment. The Bluegrass State Skills Training Corporation (BSCC) awarded a grant of $50,000 for training, which was matched by about $117,000 from Mid-South.

In order to prepare these workers for a high tech work place, the program had to start with basic skills. Even many of those with high school diplomas were functionally illiterate -- could read but not comprehend. The training instructor admitted to being "shocked by the willingness to accept the [poor educational] situation." The core elements of the program were

- Basic Adult Education Remediation
- Principles of Manufacturing
- Electronics Theory and Assembly
- Injection Molding

The curriculum was demanding and comprehensive. Learning how to do was not enough. Once the basic skills reached an adequate level, the class was required to become proficient in reading blueprints, learning how to use precision measuring instruments, and understanding electrical and electronic circuitry and basic statistics. The last meant being able to apply the statistical concepts used in control charts and understand the W. Edward Deming philosophy of statistical process control (SPC). Statistical process control is becoming a core element of technical education. According to Steve Zimmer. executive director of the BSSC, most major companies locating or expanding in the state now require a certified SPC program. Mid-South is no exception.

Although all those who went through the programs had to demonstrate knowledge of these basic manufacturing principles, the group of 40 that received the stipends and took

the more intensive course also learned about more types of equipment and operations. They learned about injection molding, including basic chemistry, and about the electronic equipment. As a result, they will have more flexibility within the plant.

At Mid-South, students were quite proud of their new mathematical skills, and even seemed a little surprised at the proficiency they had achieved in an abstract topic. "It gave me confidence more than anything," one recent graduate said. "I may tackle something out there I don't know anything about, but at least I got confidence that I will know about it."

At the conclusion of the program the graduates prepared a presentation to Mid-South management and community leaders on what they had learned. Individuals who six month earlier were considered functionally illiterate stood up in front of an audience and video cameras and described the technical aspects of production. For many, it was a major hurdle. According to one, "we got up in front of the big shots and told them what to do. It was kind of spooky, but we did it!" A videotape of the final presentations to management was indeed impressive, especially considering the status of those entering the program just a few month earlier -- undereducated, unemployed, and with little self-confidence.

The training program was not what states refer to as customized training, which prepares employees to perform a specific function in a specific setting. It was a combination of education and training intended to prepare well-rounded, flexible workers, something many traditional firms have been unwilling to do for fear they will be lured away by higher-paying jobs.

Mid-South's program included not only preparing the 17 students without high school diplomas to get their GED, but opening up the program to others in the area. By the time the program was over, all 17 students, along with 51 other residents, had passed their GED examinations. Not only did they finish their high school education, but the students insisted on a formal graduation ceremony complete with caps and gowns. The entire community shared in the accomplishments of their neighbors. Adults ranging from 20 and 50 years of age, many with their children present, marched into the school gym to "Pomp and Circumstance." U. S. Congressman Hal Rogers of the fifth district was there to greet what the papers called "Jackson's Second Chance Class of '87." It was such an unusual event that Kentucky television did a thirty-minute special on the graduation.

What was so different now that caused these individuals to learn when they had failed in the school system? "In high school they didn't really care about us. In this program they're concerned about us."

Despite the confidence that the training instilled in the employees, few interviewed expressed any interest in going on, for example, for a two-year technical degree. They just wanted jobs. But, they quickly added that they knew they had the ability to go, just not the interest. Hopefully some, however, will choose to go on to postsecondary education because the company asserts that it wants to fill its more technical positions from within, to have people advance rather than recruit from outside the area.

Effects, Short- and Long-Term

"I think the plant is going to change Annville," the coordinator of the Jackson County Ministries predicted. "Already, we have a group of citizens working to incorporate the village....This is going to mean some things will be different -- village real estate taxes and natural gas, more people and more services." Incorporation also could bring fire and police protection, better recreation facilities, sidewalks, curbs, street lighting -- and a more formal mechanism for planning for its own growth, apart from the county.

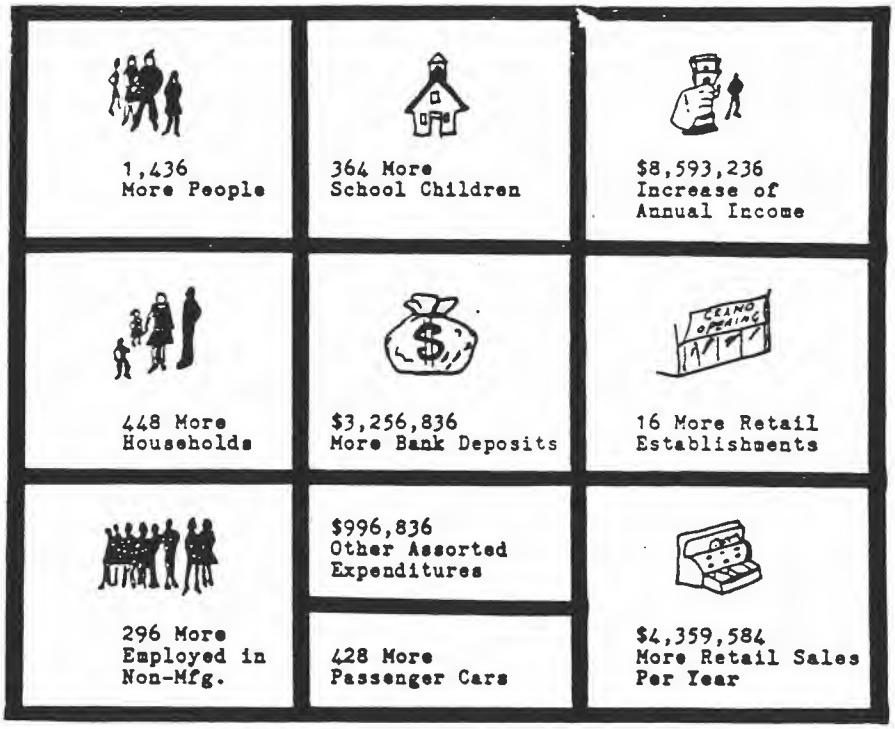
"There's no way we can even begin to gauge the impact that Mid-South's going to have on this community," Industrial Authority Chairman Lewis Ray Norris admitted, leaving the clear impression that nothing would remain the same. The changes in the area's attitude toward economic development had already undergone a dramatic turn-about. Since Mid-South decided to locate in Annville, the county's development group received the Mike Duff Award, given annually to the outstanding development association in the state of Kentucky and it has been nominated for national honors from the U.S. Department of Agriculture.

The fact that the plant location was expanded into a potential industrial park attests to the determination of Annville not to be satisfied with Mid-South as the only major employer and become a company town. They have already bid on two other plants, unsuccessfully. One was seeking an existing facility to move into and the other was a joint venture with Toyota that fell through. But the county is still pushing hard and expects to have a booth in this year's Governor's Economic Development Exposition. One Mid-South manager believes that "once other industry has seen that the Appalachian people can manufacture parts as complicated as printed circuit boards and work with parts as complex

as electronic components, they're going to take another look and say 'maybe we've overlooked a valuable work force'. Sooner or later those people are going to have to recognize the great wealth of the South as an industrial producer."

The Mid-South plant itself, however, will undoubtedly expand the local economy. County development specialists predict that the plant will draw 1,436 more people and 16 more retail establishments, and will bring in about $8.6 million in annual income and $4.3 million in annual retail sales (Figure 1). It will undoubtedly increase land values as well. The land owned by C. B. Carpenter across the road from the industrial park will probably bring far more than the $600 per acre paid for the park. Residents have already received numerous inquiries about house rentals, something that rarely happened in the past.

Figure 1
Expected Outcomes for Jackson County



Mid-South would give Jackson County new hope, confidence and a sense of real pride. It would improve all aspects of the quality of life in Jackson County: Better Economic Opportunities;
Greater Development Opportunites;
Better Infrastructure;
Greater Independance;
New Leadership and
Increased Tax Base For Better Schools and Other Services.

Source: Site proposal submitted by Jackson County and Annville to Mid-South Electrics, Inc.

The community appreciates the investment that Mid-South has made in the plant and in creating a more productive work force. Three young employees sitting in the plant snack area talked about their commitment to the company. They knew that Jackson County was considered a prime site. After all, no business of any size had ever come there before. They were fully aware of the risks the company was taking by coming into an area with low educational levels and minimal industrial infrastructure and the confidence in them -- and responsibility -- it implied. As one young newly trained employee said, "They [Mid-South] could have went anywhere, but instead they hung right in there with us."

The influx of new people also could alter local lifestyles. Community life had already begun to change though, even before the plant. An older resident summarized the differences. "We used to know everybody who lived in this house or that. If someone was sick, you went and stayed with them. Now they go to the hospital." The new plant, expected to bring more than 1,400 new people to the county, could accelerate the rate of change.

The most far-reaching effects on the area, however, may be on attitudes toward education. The people getting the education are understandably proud and place new value on education. Training instructor Jay Moses believes that "one of the most refreshing aspects [of the program] is that these people will make their children go to school, will break the cycle of perpetual illiteracy. We'll have a next generation of children who will learn the importance of education from their parents."

Lessons from Jackson County

"The secret of rural development," according to Steve Zimmer, Executive Director of Kentucky's Bluegrass State Skills Center, "is to grow successful CEOs who come back and build plants." Though said in part in jest, there is a great deal of truth in his words. And such businesses are more likely to stick it out through hard times. Dr. Lee Todd, Chairman of Kentucky's Council on Science and Technology, told a state symposium in November 1986 that "Kentucky companies that are started by Kentuckians will stay in Kentucky."[1] Leadership is crucial to successful development. But so are low wages and a

[1] *21st Century Resourcefulness*, Sypmosium Proceedings and Recommendations (Lexington, Kentucky: Kentucky Council on Higher Education, November 6,7 1986).

motivated work force, state assistance, community cohesiveness and support, and improved management methods.

The situation in Jackson County suggests that some businesses are willing to invest heavily in training up front if they can anticipate a long-range pay-off -- that is, reliable and hard-working employees willing to work for low wages and likely to remain with the company. Wages and work ethic were mentioned time and time again as key advantages. The county aggressively used both to attract the plant. On the one hand, it is distressing to find that the South still has to rely on low wages so heavily, the same strategy that attracted the older labor-intensive industries. On the other hand, while the starting wages are very low by national standards, in the context of local conditions -- rural areas where costs of living are well below national averages and the people are without previous hope of economic improvement -- it represents a major improvement for the people and an avenue of mobility.

The state and federal programs that the county put together helped ease the economic risks to Mid-South. Education and training assistance was particularly important. The Displaced Worker and Disadvantaged Worker Programs of JTPA, a grant from the Bluegrass State Skills Corporation, and in-kind assistance from the state departments of adult education and vocational education supplemented the company's own considerable investment in education and training. But the availability of stipends, which are no longer allowed by JTPA except under unusual conditions, was the factor that gave students the opportunity to spend enough time in the program to acquire the skills and knowledge to become flexible, high-tech employees. Yet the effect of support for training has effectively been neutralized by the fact that every area is doing it. Thus, the subsidies are only a factor if they are not available. Companies assume that state and federal training subsidies will be available wherever they locate.

An EDA grant for the industrial park, a CDBG grant and low-interest loan for equipment, and an excellent price on the land from a local owner rounded out the package of incentives for Mid-South. They did not, however, seriously affect the location decision. Help from personnel at the Kentucky Department of Commerce, BGSSC, and the University of Kentucky were factors that helped the county prepare a successful proposal, and impressed the company management. It was the cumulative effect -- the hard work that went into the proposal and the cooperation of many local organizations --that was the most important factor.

Mid-South Electrics is far more technologically advanced than any business for miles around. The differences in the work performed, however, are due less to technological advances in equipment than to changes in management philosophy that accompany the technology. The reorganization of the workplace to give workers more responsibility for quality and to make them more flexible is what demands different and higher-order skills.

What the Future Holds in Store

Will an industrial park, if successful, bring other good job opportunities that will compete for Mid-South's work force and move wage levels up? Or will it stabilize and diversify the labor market? Given commuting patterns among adjacent counties, there are probably still plenty of people desiring jobs. The Kentucky Commerce Cabinet estimates that in 1986 the labor supply in Jackson County was 3,078 residents. And how will the plant alter community life? The fact that many of the new management personnel have Kentucky ties or are at least from the small town South ought to minimize cultural disruptions.

Mid-South Electrics is just starting to build up to its expected operating state of about 300 employees. Can the company maintain the training program and the high morale and quality of the workforce, or has it already taken the best the area has to offer? Another group is now going through the education and training, a group of mostly women with lower levels of educational attainment than previous classes. Most read and compute at about the fourth grade level. They have children to take care of at home, are mostly on welfare, and have little confidence in themselves. Staff were still teaching them simple fractions. It will take a long-term commitment to and investment in education and training to bring them up to the level of the earlier class, which started with higher skill levels and received more class time. But the community is fortunate to have a company that rejects the conventional notion of customized training -- preparation for a specific task in a specific company -- for education and training that will serve the individual in a wide range of occupations and companies. They're gambling on company loyalty in the short term and changing attitudes toward education in order to have a better-educated work force for the long term.

Mid-South president Jerry Weaver is committed to training. "When I went to school at Annville, it was a strenuous training program, so it's ingrained in me to train and to repay because of what people have done for me in the past. Someone paved that road before I got there and I have to pave the road for someone else....I have a personal obligation to training, and as long as it is economically feasible, training will be part of the facility."

The community spirit and endemic to small towns and to Appalachia should help the present group of students succeed. A group of young men who had recently successfully completed the training program are giving the new and still uncertain class the support and encouragement they need. "We went down there and told them to hang in there. They're shook up. But it got to be like a piece of cake there at the end. We told them that."

CASE STUDY IV

CHANGE AS CONTINUITY IN A SOUTHERN RURAL COUNTY: *POWERGLIDE, INC.*[1]

by Emil E. Malizia

The Setting

Too many rural areas in the South are suffering from stagnation or decline. They lack the amenities of larger areas, access to interstate highways, proximity to rapidly growing metro areas, and the economies of agglomeration arising from size and density often needed to attract high-growth companies or to encourage expansions of existing companies. Research by the Southern Growth Policies Board and MDC Inc. documents the poor economic performance of many such areas in the South.[2]

Magnolia County generally fits this profile. It is not included among the centers of commerce, culture, or transportation in the region, although it is located within 50 miles of a small, rapidly growing metropolitan area. Magnolia's population of about 20,000 is 30 percent Black; about half the population constitutes the civilian labor force. Almost 10,000 people reside in its only urban area and county seat, Harrison. Downtown Harrison, while modest, shows off several attractive historic structures. Most of the new commercial development -- a supermarket and fast-food establishments -- are along the state road that skirts the town.

The county has higher unemployment and lower per capita income than the state averages. Its industry mix is dominated by traditional nondurable manufacturing, notably food processing and apparel, although some higher-growth durable goods manufacturers of machinery and equipment are present. No labor unions are represented in the county.

The population declined for 50 years, until 1970. Since then Magnolia County experienced modest but sustained population growth approaching one percent per year, with slightly faster employment growth. Based on typical indicators of economic growth and well-being, it is outperforming many rural areas with similar socioeconomic profiles.

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[1] All names in this chapter have been changed to conceal the identity of the company.

[2] Stuart A. Rosenfeld, Edward M. Bergman, and Sarah Rubin, *After the Factories* (Research Triangle Park: Southern Growth Policies Board, December 1985.) and *Shadows in the Sunbelt* (Chapel Hill: MDC Inc., May,1986.)

Why is this so?

Although the county is quite rural, the small metropolitan area that is within an hour's drive offers important resources, including business and financial services, a decent airport, cultural activities, and jobs. Recently, a modest number of residential lots in the county have been sold to people from that metro area.

Like most nonmetro counties, there is net out-commuting of workers. About two people leave Magnolia County for work for every one that comes in to work from adjacent counties. The surrounding areas, though not booming, manage to provide jobs for one-third of the county's labor force. Seasonal hiring in Magnolia County draws workers from an area of over 100 miles.

More important than the larger regional economy, the major local employers in Magnolia County have stayed in business for over 50 years and many have expanded in the last 10 years. One food processing company, which markets a well-known brand of products in the region, initially drew upon locally grown agricultural products but now has achieved a scale of operation that requires the purchase of produce from a multi-state area. Another major company has one of the largest nursery operations of its kind in the South. An apparel establishment, a branch facility, has consistently employed several hundred workers by maintaining market share in a very competitive segment of the clothing business--hosiery and underwear. Apparently, these major companies are well-run enterprises that have remained competitive in their respective industries. Moreover, the major industries are not linked economically, resulting in more economic diversity than is typical of many counties of similar size.

The major employers are both locally based independent concerns and branch facilities of large national companies. These major and successful employers who now have extensive capital investments or land holdings in the area appear to have a long-term commitment to the county.

The Chamber of Commerce in Magnolia County has an active program to assist existing industries. Local employers participate on a committee that studies community-wide and labor-oriented issues, with a strong focus on employer-employee relations. The committee sponsors educational seminars for management and conducts periodic wage and fringe benefit surveys in the area. The results are shared among the participating companies. The committee has improved communication and cooperation among local

companies and is partially responsible for the good relations that exist between the businesses and the town and county governments. In addition, the committee provides technical assistance. For example, members recently offered management advice to a local person who had launched a new company but who lacked business training and experience to pursue a viable idea.

The local governments are healthy and fiscally conservative. The county commissioners and council members, both black and white, are long-time residents of the area with a sense of history and a preference for gradual change. Although Harrison has no formal mechanism for long-range planning, the town's day-to-day operations appear to be well-run. Public and private investments in the downtown area reflect and enhance the area's vitality. The structure housing the library, for example, is Harrison's showpiece.

From an historical perspective, the area's economic viability seems related to the existence of many small agricultural holdings rather than the large plantations typical in many parts of the South. The latter areas continue to reveal the contrasts of wealth and poverty. Concentrated economic power is correlated with concentrated political power, which often acts to dampen local enthusiasm for economic development. Diversified agriculture and distributed land ownership leads to relatively equal income and wealth distributions and eventually to a larger middle class and more buying power for local goods and services. Political attitudes are more progressive than in otherwise similar areas. As a result, race and class relations tend to be less conflictual, and economic development enjoys popular and political support.

Finally, Magnolia County is blessed with good leadership, consisting of people active in local affairs and drawing from both the white and black communities. The quality of local leaders often spells the difference between growth and stagnation in smaller communities like Magnolia.

Compared to other rural areas in the South, the area's economy is performing well. The resident population shares a sense of community. An example of that spirit is evident in the widespread community support given the high school band and high school sports. An "alumni band" remains active and performs at local events. Most people believe that they share equally the benefits and burdens of the community and its future. Thus, a shared destiny mitigates the differences among local businesses, blacks and whites, employees and employers.

This setting provides the backdrop for discussing the introduction and impacts of new automated technologies at Powerglide, Inc., a manufacturer of automotive parts.

The Initial Investment

The Facility

In the mid-1970s, community leaders worked very hard to acquire the location of a branch facility of Powerglide, Inc., a large multi-national company. Powerglide, headquartered in Connecticut, has production facilities located in the rural South as well as other regions of the U.S. and nine foreign countries. While the site selection decision was being made, Powerglide, Inc. was already leaning toward locating in a rural area of the southeast, where it could operate at relatively lower costs and in a non-union environment. The company was also seeking sufficient electric power and good access to suppliers and markets. At the time, no full-time economic development official worked in Magnolia County, and the town manager, who had a background in engineering, took on the recruiting task. He was the key individual involved in attracting the company to Magnolia County.

After delaying the decision to invest in a new facility until the end of the economic downturn of the early 1970s, Powerglide Inc. chose Magnolia County as the site of its new facility, and the company made substantial investments in a well-designed plant outfitted with state-of-the-art equipment. The plant provided ample room to house several distinct fabrication operations while circulation was facilitated by the efficient layout. At the time of the investment, state-of-the-art equipment was mechanized, but not computer-controlled. Although domestic machining equipment suppliers once dominated the U.S. market, the new equipment for the facility was purchased from both foreign and domestic sources. There was no local participation in the construction financing. At the time of the initial investment, prospects for growth were bright, but as a supplier to the automotive industry Powerglide's business was susceptible to the cyclical nature of that industry.

Some of the area's large employers were concerned at first about competition for jobs, that the company would take workers away from existing industries and push up wages. But these impacts turned out to be minimal, and little worker turnover occurred. Because the operation attracted job applicants from a forty mile area, the labor market impacts were dispersed beyond Magnolia County.

Overall, the economic and fiscal impacts of Powerglide's initial investment were strongly positive for the county . The facility increased demand for local public services, but it did not exceed existing capacity constraints. Powerglide became be an important customer for the town's electricity, gas, and water and sewer services. The volume of electricity consumed by the facility eventually enabled the town to receive power at a lower wholesale rate. Furthermore, the county and city collected increased taxes on both the land and equipment at Powerglide, and larger payrolls increased local earnings and spending and in turn generated more local taxes.

Over the years, Powerglide has been a good corporate citizen, and top management--some of which has turned over--has become involved in civic and community affairs. The company participates in the local chamber of commerce and has become well integrated into the community.

One reason that manufacturing plants are so intensely sought by rural communities is that they are expected to generate large numbers of related jobs in the area through what is often referred to as a "multiplier effect." Although the multiplier effect of Powerglide's branch facility was considerable, it was circumscribed as well. Almost all material inputs were purchased from outside of the area, local inter-industry multipliers were close to zero. Local purchases were limited to land, labor and public services. The multiplier effects that did occur stemmed almost entirely from local expenditures of the company payroll.

The Early Years Before Automation

The company transferred top management and engineers from other sites to its Harrison facility and hired the rest of its work force locally. While the original facility was under construction, prospective management set up equipment in a vacant downtown facility and trained the initial group of employees. The company made a large investment in training, and it also received assistance under a state program that paid trainers provided by the company. Approximately 15 percent of the training costs were reimbursed by the state. Many of the initial trainees are still with the company and some now hold supervisory positions. The current plant manager, who comes from an adjacent state, was one of the original local trainees.

After several years of operations, the United Auto Workers (UAW) attempted to organize the facility as a continuation of its organizing efforts in a neighboring county. The drive, which lasted about two months, ended with a two to one defeat for the union. The

effort to unionize grew out of worker grievances prompted by rapid expansion of production, pressure to increase the pace of training, inexperienced supervisors, and inconsistent treatment of workers with similar jobs. The plant manager and top management met with all workers in a series of small group meetings, acknowledging problems and promising to address worker grievances. The issues were resolved and neither side initiated National Labor Relations Board filings as a result of the campaign. Subsequently, the plant became more productive than any of the company's other domestic manufacturing facilities.

As an auto industry supplier, Powerglide was forced to adapt to changes in that industry. For example, just-in-time inventory methods adopted by the automakers generated the need for Powerglide to use frequently air freight services provided at the airport in the nearby metropolitan area, in addition to usual shipments by trucking carriers. The concern in the auto industry for human resource development also spread among its suppliers, and Powerglide gives serious attention to employee education and skill training. The company has adopted a management philosophy that emphasizes education and training as a way to increase satisfaction and reduce turnover among workers. This philosophy is in part a response to the threat of unionization.

In the early 1980s, new management at the corporate level decided to centralize the company's research and development efforts, by creating a new manufacturing development center located in Atlanta. The development efforts at the center focus on the employee, and how the organization of work directly affects the productivity potential of new technologies. At the Atlanta facility, the staff is developing productivity improvements through dramatic increases in employee involvement in and responsibility for production. Product development is done primarily at company headquarters in conjunction with the company's sales personnel, most of whom are trained in engineering. Process design involves sales and engineering staff, and is done both at headquarters in Connecticut and at the development center in Atlanta. With this corporate division of labor, the Harrison facility is devoted primarily to production, though some process development is done on-site.

The Second Investment: Expansion and Automation

The restructuring of production that occurred in the auto industry extended to its suppliers as well. In the early 1980s, capital expenditures for robotics and other new technologies soared. Given predicted gasoline price increases, Powerglide perceived expanding markets for diesel engine parts. To be in a position to compete for this growing market, the company planned to introduce computer-aided manufacturing as part of an expansion plan that included new production lines for a new diesel engine part.

Six years after opening, Powerglide invested $16 million in expanding and automating its Harrison plant. Management at Powerglide considers the investment in automated equipment part of a long-term strategy to automate the facility and introduce more sophisticated equipment. The expansion increased the size of the facility by almost 50 percent to 150,000 square feet. Although the original facility was modern and highly mechanized, this expansion introduced computer-controlled equipment for the first time in the areas of material handling and material processing. Future investment in computer-controlled equipment will involve the areas of testing and finishing.

Like many U.S. manufacturers, Powerglide's investment was a response to increasing foreign and domestic competition, and it represented a desire to remain current, or state-of-the-art, in its production technologies. The automation decisions have been informed largely by sources within the company and were made primarily at headquarters, with involvement of the Atlanta development facility staff.

Powerglide may not have pursued the expansion and automation project if the facility were not proximate to the small metro area. With just-in-time inventory the company has made frequent use of both overnight federal express service and the metro area's commercial airport. The small size of the part plus efficient packaging make air freight economically feasible for the company.

In the original part of the plant, the products that were made before the investment in automation continue to be fabricated using mechanical metal-machining processes. In the new area where the automated processes are located, the new product line is being manufactured. The focus of the discussion that follows relates specifically to this new area and new production process at Powerglide's facility in Magnolia County.

The new technology changed the production process from low-volume batch processing to two high-volume continuous flow processes that eventually will be linked mechanically. As a result of this process change, product quality has increased overall while unit costs have been reduced dramatically. Also, the new technologies assist management in better monitoring the production process. Capacity, output, and to a lesser extent, productivity and profit have all increased due to automation.[1]

Because the new equipment at the plant added capacity, Powerglide, Inc. was able to win a contract to supply a specialized auto engine part to one of the "Big Three" automakers at very high volumes. The company sought to capture most of the market for the product. Events, however, caused plans to go awry, for two reasons. First, the auto industry's policy of multiple sourcing forced Powerglide to share the market with other domestic and foreign suppliers, with stiffest competition coming from Swedish and Japanese companies. Second, the anticipated growth of the diesel engine market, for which this part was designed, never materialized. Corporate headquarters, realizing a potential excess-capacity problem, called on its engineers to find new applications for the part. The engineers were able to adapt the part for use in gasoline engines and to document the increased engine efficiency that would result. Automakers began using the part, and as a result the company has gained a 75 percent share of the market.

Automation and the Work Force

Employment Levels and the Nature of Work

Employment in the new facility has reached 400. Most of those jobs are higher skilled and better paying than the county averages, and higher skills are required as a result of of the new automated equipment. As the employee relations manager explained, the need for manual labor was reduced while the need for workers more skilled in operating expensive, sophisticated equipment increased. At present, about 85 percent of all jobs at the facility are considered skilled or semi-skilled positions.

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[1]Productivity is higher during the second and third shifts when indirect labor is not present in the facility. This increase is explained partly because most maintenance work occurs during the first shift but also because management, supervision and employee participation of all types are concentrated during the first shift and require the time of direct labor.

The racial composition of the work force at the plant compares favorably with the racial composition of the area -- about 30 percent. There does not appear to be any concentration of one group of workers in particular types of jobs. There were differences, however, in the work performed by men and women at the plant. Men appeared to dominate sections involving the handling of heavy materials and more technical operations, while women appeared to dominate tasks requiring finer manual dexterity, such as the finishing and packaging of final products.

Because the automation was tied to the introduction of an essentially new product line, no layoffs were necessary--in fact, about 50 new employees were hired. Almost all of the new hires came form the local area, and another five were transferred from within the facility. Unlike the popular view that automation results in drastically lower labor requirements, Powerglide's employment has increased. Now, about 25 percent of the total work force at the Harrison facility works directly with the new, automated technology.

Simple generalizations, such as automation results in less employment, cannot be supported by this case study. The relationship between automation and employment levels is far more complex. On the one hand, unit costs and labor requirements were higher using the batch technology in place before automation. Since automation reduced unit costs and labor requirements, it is accurate to say that less labor was needed after automation per unit produced. Yet this conclusion is both irrelevant and misleading. The company had to change to continuous flow technology to become competitive. It had to manufacture its new product at significantly higher volumes and at lower unit costs to be viewed as a viable supplier. By greatly increasing capacity, the facility required more labor overall. Thus, it is more correct to conclude that the automation, which was market driven, resulted in increased employment because the market demanded a competitively priced product that had to be manufactured in very large volumes. Yet this conclusion does not examine the entire picture. Whether product substitution and dislocation occurred elsewhere is unknown. For this facility in this community, the demand for labor increased.

Work has also changed qualitatively at Powerglide. As a result of automation, the production process is more flexible, and workers using the new equipment exert greater control over it. For example, the two lines that received most of the automated equipment constantly move and fabricate products. One worker shuttles semi-finished parts from one line to the other, though eventually the company would like to have the two lines mechanically linked. The operators watch the continuous flow process of each line, checking equipment readings and visually scanning the processes. They can make

adjustments to improve product quality occasionally and can do so with only minor disruptions to the flow of production. They can shut down the line if a problem occurs. Their equipment measures each part and compares the measurement to tolerance limits. The operators must know how to set and change settings on the equipment to meet product specifications. Their math skills and knowledge of the metric system are frequently tested. Thus, smart, responsible workers are needed to operate smart machines. The idea that new technologies must be designed to be "idiot proof" has no place at this facility.

At the same time, automation has not eliminated all repetitive or taxing jobs. One area in the original part of the facility is uncomfortably hot, with machines apply flames to trays of parts. The older woman running this operation does difficult work. Other workers engage in counting, sorting and packaging products. They work in cleaner, cooler settings but they have very tedious jobs.

The company relies heavily on workers to suggest ways to increase productivity, and employees are encouraged to make such suggestions, no matter how minor they may appear. For skilled workers using sophisticated equipment, the company has its version of quality circles. They involve frequent meetings designed to find ways collectively to increase the efficiency of operations. This program is not directly related to automation, but is a company-wide policy that goes hand-in-hand with the modernization of production.

The company has a policy of not displacing workers due to automation or other improvements in the production process. Instead, workers are retrained for jobs at the same facility. This policy is needed to assure employees that their suggestions will not result in their termination even though management may modify a job or even eliminate a position as a result of one of their suggestions. Obviously, the company must remain profitable with a stable or increasing market share to fulfill the promise of job security.

At Powerglide, the investments in new technologies have had moderately positive impacts on wage rates, skill levels, and the number of employees with technical degrees. Wages now range from $5 to $11 per hour, having increased on average 12 percent in the areas involving automation. The production process and the equipment are more sophisticated than before the expansion, and more math is required of all new job applicants. In addition, a few new job descriptions have been added.

Education and Training

Powerglide Inc. is strongly committed to employee education and training that can be related to improvements in job-related capabilities or performance, also part of a company-wide policy that transcends investment decisions related to automation. The philosophy appears to be that work force sophistication must increase as the equipment used by the work force becomes more sophisticated. The scarcity of skilled labor was initially perceived to pose a modest limit on the pace of automation. The company does not expect to hire workers who are already trained properly and devotes considerable effort to on-the-job training, .

Powerglide calls on its full-time, professional staff to conduct skill training. On the job training usually begins with equipment vendors providing the initial orientation to the Powerglide staff. The extensiveness of the training varies with the work requirements. In one department of the plant, the training period lasts six weeks; in another major department, the training is 16 weeks long. Three candidates are interviewed, tested, and meet the supervisor for each position that arises. Math skills are emphasized. Operators must make straightforward but accurate calculations frequently, using both the metric system and the decimal system.

The selected trainee is assigned a full-time instructor throughout the training period. The company uses formal training materials that it has developed and has quiet areas set aside for training purposes. The instructor keeps a daily log that documents the subjects covered. The trainee reviews and initials the log and meets with the personnel director bi-weekly during the training period to review progress and problems.

About 85 percent of the participants complete training successfully. The remainder are terminated or placed in positions requiring less skill. At the end of the training period the worker is expected to operate the equipment without supervision. Recently, the company has begun to "cross train" workers in one department for positions in the other major department.

The company encourages less skilled workers to upgrade their skills for better positions before hiring in new workers. However, some workers prefer to stay with jobs requiring less skill. Most are older workers, with less education and who are comfortable in their present positions. Staying on the first shift rather than moving to the second or

third is also a consideration. About 65 percent of all employees work the first shift from 8:00 a.m. to 4:00 p.m.

Powerglide is sponsoring a literacy program, supported by a grant from the state obtained in conjunction with a teacher from a nearby community college. Workers can receive computer-assisted instruction for two-hour periods to improve their reading and math skills. One of two literacy buses operated by the county board of education , called a "High Tech on Wheels Learning Lab," was moved inside the plant in the fall of 1987 providing a mobile classroom right on the factory floor. Workers will be able to receive their GED as a result of the instruction as well as adult basic education. College-level classes are also available by computer and are accredited through a nearby college which is part of the state university system. Employees pursue these continuing-education opportunities on their own time.

The company has a good reputation as an employer in the local area. Turnover is very low -- about two percent annually -- and new positions are advertised word-of-mouth by existing employees. The reputation is generally attributed to the training and educational opportunities provided by the company. As a company policy, employees are reimbursed for all tuition payments whether the job-related education is for the GED or a college diploma, or for technical or non-technical classes.

Automation and the Community

While the initial facility location was a dramatic event, the automation-expansion had rather modest effects in terms of economic and fiscal impacts on the county. The city allowed tax-exempt financing through its development authority to help Powerglide finance its expansion. Industrial development bonds for the expansion were sold through the out-of-state bank serving the company's headquarter offices, and although local banks were interested, none was invited to become purchasers of the bonds. Such expansion financing would be considered private-purpose under the 1986 federal tax law, and as such, it would be much more difficult, if not impossible, to qualify the expansion as tax-exempt under the existing tax law. Besides tax-exempt financing, no public programs or local resources proved very important to Powerglide in making its investment decisions.

Although Powerglide represented a large employer relative to the size of the area, changes due to its expansion were too subtle to be noticeable. Local employers could not

detect any changes in the local supply of labor. Material and supply requirements did not change much, nor did the demand for public services. Although assessed valuation increased, the company's tax bill did not rise dramatically.

Powerglide perceived the limited number of available skilled workers as an initial constraint on the automation process, but this proved to be unimportant because adequate trainable labor was successfully recruited and because Powerglide made education and training a priority for its employees. Powerglide did used state training assistance and industrial extension services to a limited extent when making its decision to invest, but the company's training program became increasingly self-contained thereby limiting the need for publicly-funded skills training assistance.

The most important community impact of the expansion relates to new infrastructure and the prospects for future growth. The current town manager applied for and received a one-half million dollar grant from the Economic Development Administration and from state sources for a trunk sewer line. Although the line served the facility, it was sufficiently oversized to accommodate anticipated growth in that part of town. Moreover, the infrastructure increased the capacity of the treatment facility by 20 percent by eliminating a considerable amount of storm water seepage occurring due to old deteriorated sewer lines. Although significant, this outcome was dependent on the size of the expansion and not on the automated equipment introduced as part of the expansion project.

Local economic development efforts are presently focused on supporting existing industries and attracting "quality growth." Unlike other smaller communities that must recruit any employer able to help expand the economic base beyond agriculture and traditional industry, this area can recruit much more selectively due to this large branch facility and the other viable local employers. Powerglide's investment creates the feeling of security among community residents -- that because of the large investment, the company will remain in Magnolia County for some time.

Final Considerations

Powerglide, with a people-oriented management style, would like to see education and training encouraged and rewarded as a matter of public policy. It has used Job

Training Partnership Act (JTPA) and state training subsidies, and it would also like to have some version of the investment tax credit restored to reduce the costs of modernization.

Although not in favor of extreme protectionism, Powerglide recognizes that it cannot compete for certain markets against very low cost labor, even with state-of the-art production facilities. In most instances, reciprocal access to foreign markets is the more important consideration.

Beyond these rather straightforward policy considerations, the company is engaging in activities that have great policy significance, especially to the Southern Technology Council. The company has invested in the Atlanta development center, noted above, where applied research and development on the future of its American manufacturing is being conducted. The Atlanta center houses a small staff of managers and professional engineers, conducting confidential development work for the corporation. In some instances, the company contracts with a university for R&D, and in this case, the company owns the results and can protect any useful outcome from the competition by seeking patents for the process.

The corporation also has cooperative agreements with universities in its headquarter state and in two other southeastern states. Powerglide provides funding along with other participating manufacturers to the university for engineering research. The private companies suggest projects for about 75 percent of the funding while university faculty pursue projects they initiate with the remaining funds. The university retains the patent rights to any inventions and the companies share the findings, accessing the technology developed under the agreement. Direct competitors tend to avoid participating in the same cooperative agreements.

The central policy question is: are these centers and cooperative arrangements playing a key role in making U.S. manufacturers more competitive? If so, how can the public sector stimulate the advancement of technology and intercompany cooperation without infringing on proprietary R&D?

In conclusion, the major impression from the case study is a sense of continuity. Rather than representing dramatic change, automation is a reasonable extension of the struggle of U.S. manufacturers to remain competitive. And in order to successfully adopt new technologies, Powerglide Inc. is focusing on its work force by developing ambitious human resource policies that will complement continued automation.

CASE STUDY V
NEW VIBRATIONS ON THE SHOP FLOOR: *STEELCASE, INC.*

by David Perkins

Introduction

It's morning inside the Steelcase plant in Athens, Alabama, a huge hangar covering more than 600,000 square feet. The first shift has been at work since 6:45 a.m. and the noise beats down like a thunderstorm. The cacophony of sounds begins with the large brake presses that bend or form pieces of metal into some of the 40 parts that make up Steelcase Inc.'s movable office panel, the plant's major product. The press operators remove and replace the parts by hand, one at a time.

Nearby, a 400-ton automatic press crashes down, spewing out a stream of formed parts; hand welders torch the joints of panel frames while other workers braze and grind smooth the edges of the panel caps. The finished parts, meanwhile, circulate around the plant on a track hanging just below the ceiling. They are drying after passing through an automatic painting machine that resembles a huge car-wash.

In the assembly area, workers fit the pieces together, then fill them with sound-absorbing material or cover them with decorative fabric. The completed panels are wrapped in polyethylene bags, on which an invoice is taped, and sent into a machine that wraps a cardboard box around each one and seals it with hot glue. From there, the boxes are transported to the loading dock and shipped to a large and diverse group of customers that includes the U.S. Department of Treasury, IBM, State Farm Insurance, and Digital Electronics.

For most of the workers, the daily routine has changed little since the plant opened in 1979. Most jobs still require only skills that can be taught to people off the street in a matter of days. But in the middle of this gigantic, brightly lit space a new vibration is being felt.

The source is a row of robots that weld panel frames automatically. The robots are a part of a long-term, $7 million transformation of the shop floor that Steelcase undertook four years ago. In addition to the robots, three rollforms (computer directed, multi-die presses that punch and fold parts of the panel) and the automatic packaging machine have

been brought on line. Some of the new equipment is labor-saving but not computer-directed -- automatic paint guns and the 400-ton press that fashions parts that once had to be run through several press brakes in one blow.

A $1-million automated manufacturing unit with a "pick and place" system will fashion complete panel caps from raw coils of metal. The machine -- similar to a rollform -- is being designed at the northern headquarters and should be in place within a year. It will eliminate 15 brake press, spot welder and grinder positions. Five other rollforms and an additional 400-ton press are on order.

The automation program at the Athens plant so far has been limited in scope, affecting perhaps 50 of its 660 workers. By 1990, new equipment will have eliminated an estimated 50 jobs, although plant expansions should make layoffs unnecessary, the plant's management says.

But, beneath the surface, the technology is already challenging the plant's divisions of labor, pay scales, and management approaches; requiring even better communications between labor and management; and pressing the company to think about the need for advanced training from the shop level to management. The reality of working with technically advanced equipment on the shop floor proved to be quite different from the plans of the company or the vendors. Higher-order skills and more knowledge were required that had been foreseen in the plans.

A Growing Company

The 1980s have been good to Steelcase. The expanding service economy, with its growing number of white collar workers, and the popularity of open offices with work spaces separated by movable panels, have made it into a $1.6 billion-a-year company. Steelcase is now the world's largest manufacturer of office furniture. Sales increased by almost 50 percent in the last three years.

Like a flourishing tree, Steelcase has opened branch plants in North Carolina, California, and Alabama in addition to the original complex of plants and headquarters in Michigan. It has acquired subsidiaries and entered into joint ventures around the world.

Despite its size and world-wide reach, however, Steelcase has kept the work-hard-and-we'll-take-care-of-you tone of a small, family-run company. Its management principles have changed little over the 75 years since it produced its first line of office safes and wastebaskets made of sheet steel. They can be summed up by three commandments -- delegate control, promote from within, and keep communications open. Although Steelcase's products are designed at the Michigan headquarters by professional engineers, each plant is a semi-autonomous "profit center," responsible for choosing its machinery, designing its manufacturing process, and for lowering costs.

In turn, each plant's shop floor workers are given a high degree of control over their machinery, expected to monitor quality closely, and rewarded for exceeding production schedules. There are few supervisors and technicians. "We feel our people will want to do better if they have a larger responsibility and feel supervision has confidence in then," says the Athens plant manager.

The Athens plant is one of Steelcase's smaller but faster growing plants. It started out in 1979 with 68 employees, and as demand for the movable panel has risen, grown to 660. Since May 1987 alone, 160 new workers have been hired. Of the 660 total, 58 are management (including foremen, floor supervisors, and main office staff of seven manufacturing engineers and nine senior managers). Among the hourly workers, 150 are in manufacturing (press operators, welders, robot and rollform operators) and another 200 are in assembly. The balance are in maintenance men, electrical and janitorial worker, painting, materials handling, forklift operation, customer service and shipping.

Despite the hectic pace of production, the atmosphere inside the plant is easy, relaxed, with the feel of a custom shop rather than a mass manufacturing operation. Managers and workers call each other by their first names. They talk about yard work, politics and Alabama football. They eat side-by-side in a cafeteria that is sumptuous by most plant standards. There are formal channels of communication as well. Among several worker-management committees, a "profit improvement" committee has made suggestions for design and process changes that have cut costs by millions of dollars.

It is a point of pride and policy with Steelcase that it pays higher-than-average wages for each county in which it operates and rarely lays anyone off. The Athens plant pays more -- in wages, incentives and bonuses -- than any manufacturing firm in Limestone County or its neighbors, with the exception of a huge General Motors plant, which is unionized. "And we're competitive with them," says the human resources

manager. An incentive plan rewards employees who produce more than the level for their base hourly rate. Steelcase employees' average pay in 1987 was $13.50 per hour, which exceeded the state average of $8.73 per hour and the U.S. average wage of $9.73, according to the U.S. Bureau of Labor Statistics (March 1987).

Layoffs are almost unheard of at Steelcase. When jobs are eliminated, workers generally are reassigned, retaining their previous wages for six months if they move to a lower-paying position. As for getting fired, that "almost takes an Act of Congress," as one manager put it. "You have to be a sorry, sorry employee."

Of the five people fired at the Athens plant last year, three were dismissed after failing the company's drug rehabilitation program. No one has been fired for incompetence in years, says human resources manager Simmons. "We usually can find something for them to do. In the early years we had a few who slipped in who couldn't read or write -- they got their wives or somebody to fill out their forms -- and that created some problems. But we found something for them to do." The plant protects its permanent workforce by hiring large numbers of temporary employees during peak production periods. With its high wages and excellent benefits, the Athens plant can hire the best of the area's underemployed. When the plant advertised last May for 100 new job openings, 6,000 people applied.

"Promote from within" is another verse in the Steelcase credo and one to which it does more than pay lip service. All but one of the Athens plant's twelve foremen have been promoted from the shop floor. So have six of the eight manufacturing engineers. All job openings are posted so that everyone is aware of the opportunities.

The company makes no bones about expecting a full day's work out of its employees. Shifts are nine hours, with a half hour for lunch and two 15-minute breaks. Employees are not allowed to take phone calls, except in emergencies, during work hours. A strict behavior code with penalty points is enforced for a variety of infractions, including careless workmanship, tardiness, absence or theft. If enough points are accumulated, an employee may be blocked from bidding on a promotion, or lose a merit supplement to salary for several months.

The plant also has a strict drug abuse program, which it started three years ago. It involves mandatory pre-hire testing and random testing for current employees. An

employee who tests positive is referred to a clinic at the company's expense. If caught a second time, the employee is fired.

Steelcase's mix of strictness and benevolence may smack of old-style paternalism. But they have proved successful -- at least by measures of employee loyalty (of the 68 original hourly employees, 54 remain on the shop floor, 8 have been promoted to management), high productivity and absence of labor disputes. Dissatisfaction or anti-management sentiment is hard to find. Says Karen Middleton, lifestyle editor of the Athens News Courier: "I've never heard of a single disgruntled employee, and that's remarkable."

Courting a Cadillac

Twenty years ago, Limestone County was good land for growing cotton and raising cattle and not much else. Manufacturing jobs were so scarce that Athens State Community College started its own lingerie factory for its students. A high school graduate with ambition had the choice of going to work in a cut-and-sew plant, farming, or leaving the county.

"That was the big complaint when I was growing up. There weren't any jobs," recalls Bob Dunnavant, Jr., vice president of WJMW-FM in Athens. "Most people either left town, or they took jobs in Huntsville or Decatur."

Today, Limestone County, with a population of about 46,000, has almost 35 percent of its workers in manufacturing. This is far above the national average of just over 20 percent. Poultry processing plants, a steering gear division of General Motors, auto transmission parts and the Brown's Ferry nuclear plant of the Tennessee Valley Authority are parts of the new industrial base. While few large plants have located in the county since the late 1970s, it continues to have one of the highest job creation rates in the state.

To some extent, the transformation was the work of effective boosterism. The Athens-Limestone County Development Association was formed in the late 1960s, a broad-based body with representatives of county government, city government and area industries. Cooperation among entities that often compete has created a powerful recruiting muscle. "It was a united effort," Dunnavant says. "All of the government functions have worked together to accommodate new industry."

When the group persuaded Steelcase to locate there in 1979, some regarded it as the jewel in the county's industrial recruitment crown. "They're a Cadillac Industry," says Charles Durham, and Athens accountant and coordinator for the Association. "And their business philosophy fits in with the philosophy of the community. They're not bashful about profit but they're people-oriented."

To be sure, northern Alabama has all kinds of allure for basic manufacturing industries like Steelcase. It is a largely union-free area in a state with a right to work law. Productivity is high and costs are low. Alabama's property taxes are the lowest in the nation. Its production wage ranks 39th among all states. Labor is abundant in the urban areas in or near the Tennessee Valley -- Huntsville, Decatur, Muscle Shoals, and, not too far away, Nashville and Birmingham.

The industrial boom in nearby Huntsville, spurred by Marshall Space Flight Center and Redstone Arsenal, has created a five percent population growth rate, raised the per capita income and given the area new political clout. The University of Alabama at Huntsville has become a center of high technology research. Interstate 65 was paved through Limestone County in the early 1970s, linking the once-depressed South to the industrial heartland.

The Tennessee Valley Authority has enriched the region in electrical power and in parks, fishing and boating spots along the Tennessee River. A TVA nuclear plant in Limestone County created almost 7,000 jobs, more than all of the county's manufacturing jobs combined.

Of all these enticements, however, the non-union atmosphere carried special weight for General Fireproofing Company (GF), a leading manufacturer of office furniture and a Steelcase competitor. After a series of labor disputes in Ohio, GF had decided to close its Youngstown, Ohio plant and build a new one elsewhere. Through an industrial realtor, it heard of 140 acres of farmland that the city of Athens had purchased in the early 1970s for a new industrial park. (The city's first park had filled up in the late 1960s.)

Financed with city industrial bonds, GF bought the land and built a 330,000-square-foot plant on the site. The plant was almost complete when the company changed its mind. With the economic downturn of the late 1970s, a change of leadership at GF and growing political pressure at home, GF decided to keep its Youngstown plant and put the Athens plant up for sale through an industrial realtor.

At that time, Steelcase was looking for a new plant that could be revved up for production in less than a year. The company was preparing to introduce a new product -- a deluxe panel -- and the Michigan plant could not make both the new and the older 2-inch panel, orders for which were already becoming backlogged. The new plant would take over production of the 2-inch panel, until it was phased out and replaced with another product line. (The 2-inch panel has defied predictions, however, and there are no plans to phase out production.)

Within weeks, 24 corporations had visited the GF plant, and Steelcase became the early and clear favorite for the Athens-Limestone County Development Association. The group was impressed by Steelcase's concern for profit, the number of prospective plant employees, its reputation for civic good works, and its people-oriented management style.

On his first visit to Michigan, Durham was taken by Steelcase's Chairman of the Board inside the main plant and introduced to three generations of a single family among the workers. "They didn't show me their fine buildings or high-tech equipment, they showed me their people," he says. "That impressed me. It was important to me that it was important to them that their employees were loyal, and that they were loyal to them." As part of his presentation to Steelcase, Durham supplied data on productivity and wage rates. He promoted the area's farm-bred, independent work ethic.

Steelcase purchased the plant through a 10-year, $8.8 million city industrial development bond issue. (As it turned out, Steelcase bought all of the bonds itself.) The land was exempted from state property taxes until 1989, when the bond issue will be paid off. Since 1979, four plant expansions have been financed with four additional bond issues: $1.5 million in 1982, $6 million in 1984, $12 million in 1985, and $15 million 1987.

"Expansions are the best testimonial to our community," says Durham. "We spend more time talking to smaller companies that can grow than bigger ones that may strain the resources of the community and end up with layoffs." With Steelcase as it's anchor, the industrial park has filled up with plants -- making fiberglass boats, corrugated containers, plastic tubes. The county is embarking on a third park.

Steelcase and the city's business community have had only a few minor differences over the years. The first concerned the plant's youthful work force. Most of the initial plant employees were young men in their early twenties. Today, the plant's average age is

29. Durham says he and others expressed concern that the large number of older members of the local labor force would be passed over, that younger workers might not be qualified to move into management, and that as a result the company would have to bring in outsiders. Despite seeking younger workers, Steelcase did find qualified employees and has promoted many floor workers into management.

On another occasion, Steelcase and the industrial board disagreed over how to go about announcing plant expansions. The plant preferred to let the news spread around the community by word of mouth. The board wanted a public announcement to show the community that its work was bearing fruit. "They're a typical family owned business -- very conservative," Durham says of Steelcase. "They never make waves to get attention. But the only way we're able to do things (as a Board) is through public sector support, and we need to able to show what we've done. Public announcements are what fuel enthusiasm." The plant finally agreed.

In general, Steelcase appears to have become the very model of a corporate citizen. During a recent visit by a reporter, the human resources manager had to cut short an interview to attend a community college booster club meeting. The engineering manager cut his time short because he was doing an efficiency study on trash pick-up for the Athens city council. Two years ago, all but one of the officers of the county Jaycees were Steelcase managers. The company set a United Way goal of $50,000 this fall, and came up with $80,000.

The Push For Automation

"Modernize!" was the order that came from the Michigan headquarters four years ago. Though the leader in its market, Steelcase had faced stiffening competition and been unable to raise prices significantly. To increase profits, the company realized it had to cut costs, increase production, and improve quality — through automation. A senior vice president challenged six plant managers to request several new pieces of automated equipment, but with a stipulation that it had to pay off in two years.

The vice president today says, however, that the corporate emphasis on automation was not really as sudden a change as it may have seemed at the time. "There's nothing new about automation. We've been picking away at it for a long time." Automated equipment had been introduced at the Michigan plant in the early 1980s and word began to filter down

to Athens and other plants, who began to make their own requests for new capital to modernize.

Steelcase is still not among the leaders in automation among its competitors, however, according to Bob Ballard, a former plant manager. He cites plants he visited in California that are much more advanced technologically. "I can only guess they were given a lot more time to pay back the cost. If we can't cost justify the new equipment in three years, I couldn't in good conscience go ahead with it. It's primarily a matter of wanting to be sure we're investing our money wisely."

Jack Stegmier says the three-year payback rule was prudent, but no ceiling has been set on the amount of money he will authorize. (Athens' managers talk of a $7 million benchmark figure.) "The more money they ask for, the more successes they're having -- provided they're using their money resources in an intelligent manner."

Cutting labor costs is not the major goal of the automation program. Rather, the focus is on reducing material costs, improving quality control, facilitating just-in-time production, and increasing output. The Athens plant is already reaping the rewards of the $2 million investment it has made in new equipment to date. In the last year, production increased by 60 percent to 600,000 panels a year, and sales reached a record $150 million. The increase in capacity would not have been achieved without the new equipment because the costs would have been too high, according to Ted Smith, Superintendent of Machine and Weld. Automation also has freed workers to do more custom orders, a sideline that Steelcase pursues mainly as a special customer service.

Improved quality control procedures have become a necessity from the bottom to the top of the line, beginning with the vendors. The plant's suppliers of metal tubing, for example, have been required to meet narrower specifications. To make sure they comply with the standards, the plant has started a Statistical Process Control (SPC) review at the receiving dock, the first phase in a plant-wide program. Eventually, workers at various stages of the automated line will be expected to use new gauges and measures with computer assistance to assure that parts meet specifications. Adapting the new technology to the plant, however, has been anything but easy.

Robots -- Working Out The Kinks

By its own admission, Steelcase embraced robots with naivete. The company thought that robots could be adapted easily to the manufacturing process and that no special support or cooperation make them work. Steelcase management was wrong in both cases. "We started out by saying, 'here's another piece of equipment. Let's set it up and run it,'" one supervisor said. "We had totally underestimated the differences in switching from a technology we'd had in our company for years and years to something that was radically new."

The Athens plant has eight robots. Five of the eight robots are large, $120,000 machines that weld the inner frames for the panels. Because the frames come in 51 different sizes, great flexibility is demanded of these machines. The two other robots are smaller, $90,000 machines and are used to weld the feet or bottom portion of the panel.

The robots have replaced about 15 of the 20 original hand welding positions, although production has already outstripped the five robots' capacity and additional hand welders have been hired. When everything is working smoothly, the process is simple enough. The operator enters a curtained work area and places the loose parts of the panel frame or foot on a fixture with guidelines for the robot. Stepping outside the curtain, he presses the "on" button on the stand, or pedestal, that is connected to a mini-computer. The computer has been programmed to move the arm along the set dimensions of the frame.

The arm moves to one corner and, with a zap of electricity, melts a metal filament at the tip that welds the pieces together. The arm moves on with an eerie accuracy to each of other corners of the frame. When it has finished, a green light flashes and the operator removes the completed frame and replaces the parts.

The robots, all made by Automatix of Boston, are only slightly faster than hand welders -- three-tenths of a minute, according to one engineer. Unlike the hand welders, however, the robots don't slow down toward the end of the shift. Thus, a robot operator can produce up to 600 frames in eight hours; a hand welder about 400. In addition to greater volume, the robots produce more uniform welds, saving material costs (gas, filament etc.) and welds that are more consistent in quality, resulting in fewer rejects.

Robots Take First Steps

Instead of purchasing the robots ready-to-run, Steelcase chose to assemble the units, develop the programming, and do the fine-tuning in-house. It was the less expensive but rougher road. Steelcase's Michigan plant had used the smaller Automatix robot but never the larger one, so there was no accumulated company expertise. A manufacturing engineer and the weld shop supervisor traveled to Boston for several weeks of training, which was part of the sales agreement. The training, it turned out, was inadequate, and problems kept cropping up.

Following the training, which occurred under ideal conditions, the engineers assumed that the robots would be set up, programmed, and produce. But it did not work as smoothly as hoped. A number of little things went wrong, such as drifting of the arm, which were identified and corrected. One problem that took weeks to solve was a voltage feedback into the computer that caused the arm to stray from its path. It only required a minor change but took a long time to solve. Engineers from the vendor and from headquarters were of little help. The Automatix engineer had never seen the large robot in the field, and he knew nothing about welding and little about programming.

Steelcase had assumed that technical problems would be minimal and that the robot operator could handle them with a little help from the engineer. (The company, incidentally, had not sent the operator to Automatix' training course.) The company also had assumed that the senior hand welder should be made the first robot operator, following its long-standing promotion policy. The technical problems turned out to be numerous and demanded more time of the engineer than he could spare. In addition, the senior hand welder was unable to understand the technology and provide the feedback needed on its performance as a welder. The welder was competent by hand but he could not relate his hand welding knowledge to the robot arm. After a few weeks, he became discouraged and asked to be reassigned to another job.

After almost six months of stalemate, former plant manager Bob Ballard decided a different approach was called for. He formed a team involving engineers, technicians and operator to work with the robots. A hand-welding set-up person who was also a computer enthusiast was made a full-time robot technician -- the first at the plant. An electrician was assigned to work with him full-time.

After Michigan approved a waiver of its promotion policies, new operators were chosen on the basis of aptitude and enthusiasm, rather than seniority. They had assumed that engineering could handle the transition, but it turned out to require a good deal more training than anticipated. The company also had not screened employees adequately. They found that to run the equipment effectively, a person must have a keen interest in it. Each operator is expected to be responsible for quality and level of output, and to troubleshoot the system. They simply underestimated the skills and misunderstood the attitudes it took to make the shift from the old-style welders to robotics.

The first machine, installed in October 1984, was working smoothly by June 1985. By then, two other robots had been installed. The engineer says the experience taught him a few things about how to shorten the learning curve in integrating new technology. "First of all, I'd define exactly how involved you're going to be (at the plant). Are you going to buy components or a system? Then define exactly who, based on qualifications, is going to be responsible for what, maintenance, operators, or whatever. Then I'd formulate the team and train them together, preferably up front and prior to receiving the equipment."

The Operator - A Higher Skill Job?

Intelligent hand welders proved essential in getting the robots to work. Without their expertise in welding techniques, the technicians could not give the computers the right instructions. With their grasp of and enthusiasm for the new equipment, problems were not unsurmountable. Nevertheless, those higher skills have not yet been reflected in higher pay.

The first robot operators were paid $8.23 an hour, the same wage they had earned as hand welders. Management expected that the job would demand no greater technical background than hand welding, and working conditions would be much more pleasant. The company originally thought that the new equipment eventually could be operated with workers at lower grade positions than hand welders. Technicians would do all the more demanding technical work and thus the welding tasks actually would be simplified. Further, working conditions would be much better than in the present hand welding area.

Working conditions were indeed much better, however, the operator's job proved to require more responsibility than the company had expected. Strictly speaking, the technician is responsible for programming the computers at the beginning of the day and

again each time an operator changes the frame size. But other small adjustments still must be made -- for example, when the raw materials approach or exceed the tolerances set for the process. Some operators are taking the initiative and editing programs, keeping production steady and themselves on schedule, a practice the company condones.

"We've had meetings with management and said, 'look, is it alright for us to edit'? They say it's OK, as long as we don't break anything," says a 27-year-old former hand welder who volunteered for the new position. He learned to edit after being assigned to the first robot on the night shift -- after only two weeks of in-house training. He found that the night technician was not as experienced as the day-time technician, and it constrained production. If editing was required, he had to operate at low efficiency or learn how to edit himself. He chose the latter, learning to edit, checking points, and setting parameters -- tasks normally carried out by a technician.

The new robot operator is convinced that in due time the operator will make the technical adjustments. "You may have a technician who does most of the programming. But with everything else, I think eventually he'll have it all." He sees the added education as serving the needs of the individual and the company. "If you don't get anything else out of the job, you're getting the knowledge. Then if you decide to go somewhere else and they have robots, you have that ready. The company gains by training the operator because production does not have to stop and wait for a technician who may not be immediately available.

The robot technician believes the operators should be trained to edit as part of the job. "If the operator could edit, I could cover more area with less paperwork," he says. Without editing the job is duller and requires fewer skills. "One of the things about robots is they can get kind of boring, once you get to running something without problems. Some of [the operators] just sit around and, you know, speak to anyone who goes by."

To the operator, the new job has been anything but a dead end. "You learn from it every day. It might not be much but you'll know how to handle something down the line. You learn about what kind of cracks you can run, the distance between you tubes. You learn how to adjust your heat and so on. You have to take what you knew over there [in hand welding] and apply it here. That takes some thinking." Steelcase is re-evaluating the robot operator's job as part of it regular review of all job descriptions because of the added responsibilities, according to the human resources manger. The operator plans to apply for a back-up robot technician's job as soon as one opens.

Announcing Change

The enthusiasm of the robot operator who learned editing was atypical. For others, the transition proved much more difficult. When the first robots were brought into the plant, the company posted a notice of the new jobs and gave the hand welders first chance to apply. It was made perfectly clear to the welders at meetings that the robots would eventually replace manual welding. Many of the welders, however, were reluctant to apply for the new jobs. They either did not believe the robots would work out and believed their jobs were going to be cut or they felt uncomfortable with the new technology and positions. Some asked to be transferred to other jobs immediately.

The robots had been a regular topic at profit improvement meetings, even before Michigan gave permission to buy the new automated equipment. Workers even suggested specific tasks that could be automated. "I've never heard a single complaint about the equipment. When you get to the basics, the [workers] were involved in the decision for robots from the beginning," an engineer said. "They were asking, 'Can you do this faster, automatically? Can we have machine to do this?' We discuss it and we still do."

But, he concedes, "if I were starting over, I'd make no announcement until I had my team selected. Then I'd call all the hand welders in and say, 'we're looking at trying out this operation. We don't know where it's going to lead. It might displace five people and only utilize one person and he'll need some extra training up front, but that person is going to be an existing person.' We weren't straightforward. We knew the one robot would eliminate maybe three people from the night shift, but we didn't say that. If we'd thrown all of the cards on the table, it could have eliminated some personal uncertainty."

Rollforms Roll in Easy

Implementation of the other major piece of automated equipment, the rollform, was less of an ordeal. It was technologically less complex and already had been tried and proven at the Michigan plant.

The rollforms manufacture inner and outer supports for the Steelcase panels, yardstick-like pieces with a series of notches and grooves. The first one was moved down

in 1985 from the Michigan plant, which had been making the supports and shipping them to Athens.

By making the parts in-house, the Athens plant saves shipping costs and shortens production time. In the past, delivery of parts -- even within the company -- had not always been prompt. "We were one of our own worst vendors," one plant official said.

A rollform takes a continuous strip of metal from a large 1,000-pound coil and passes it through a series of dies that notch it, trim it, fold it, and then cut it to produce individual parts. The $300,000 rollforms do what once took five or six mechanical press brakes. Four of the rollforms are high-speed and computer-operated. The other is mechanically run. In both cases, the operator is responsible for loading the raw material and installing and adjusting the tooling -- tasks assigned to a set-up man in other metalworking jobs, such as the press brake.

When the mechanical rollform operator wants to change the dimensions of a part, he picks up a wrench and makes the adjustments by hand. The computer-run rollform operator resets the times on the computer that determines the firing of the dies. The program itself is fixed, so no complex computer knowledge is required.

The computer-run rollform operators were sent to Michigan for two weeks of training; the mechanical operator was trained in house for three days. All were promoted from press brakes or similar basic tasks. Because the rollforms are more precise than press brakes, the operator has to be more precise in examining the quality of his output and becomes less a manufacturer and more a skilled quality checker.

"The grey area for the rollform operator's learning is to be able to spot a quality problem in the product, and find the [source of the] problem in the tooling," Herb Gooch says. "If there's a mark, which tool made it? Do you need to put more oil on it? Do you need to change the speed?"

The work with automated equipment is not as physically demanding as before. "I don't go home as tired physically as I used to, but sometimes I go home mentally drained," says Patricia Holt, a mechanical rollform operator who had previously worked a brake press. But, she adds, "the machine has its little days when it doesn't want to work right."

The rollforms -- like the robots -- have given the operators something they had very little of before: free time. The company wants operators to use the time to look for cost

and time savings. Herb Gooch urges employees, "create yourself some more free time, make your job easier if you can." During a recent visit by a reporter, the operator of a computerized rollform was seen doodling while his machine purred along behind him. On closer inspection, the doodle turned out to be a sketch of a new sequence of dies. "I'm just trying to see if we could do it any different," the operator said.

Reflecting these added skills, a rollform operator earns a grade 4 wage, which is on a par with welders, brazers, and painters and one step above the category that includes forklift operators, cycle counters and robot operators.

Retraining Management and Workers

Steelcase is drawing more on its engineering expertise as it goes about automating its plants, and this need will only intensify as the process advances, says Jack Stegmier, Steelcase's senior vice president.

"The easy things to automate are knocked out first, the more difficult automation will take more time, brainpower and money," he says, "We definitely need more expertise at the plant level. We need the engineering mind, either by experience or education." Stegmier said Steelcase has not started a management training program in automation, but "it might be something we should address ourselves to."

To get the needed expertise, the company turns outside the plant family. The Athens plant recently hired a senior manufacturing engineer who worked on automated equipment at another Athens plant to implement Statistical Program Control (SPC) and help out with automation. He was the first engineer hired from outside the company in almost five years. "Sometimes we do become a bit stale with our own ideas," said plant manager Jim Waybright. "With his talent and background, we wanted to bring someone in to give us some fresh air."

Waybright explained, "at present our engineers with practical experience are able to provide the technical support needed to implement the new equipment. Working with technical input from outside engineers, our people can do the job. We learn a lot of things by practical experience, and we get a pretty good return on our people."

The contributions of middle management, however, can be enhanced by increased education -- particularly those of the floor supervisors. The production supervisors were not given the same intensive education that workers received when the equipment was installed. According to a plant engineer, they don't get the same kind of hands-on education and consequently cannot be expected to always respond quickly to new problems on the floor.

When the automated packaging machine was installed, for example, problems arose with the gluing mechanism. Workers thought a new part should be ordered, but the supervisor, who was not involved with the engineering or the installation and was not yet familiar with the equipment, couldn't approve it. "Until he understood the machine and got involved, they couldn't solve the problem," the engineer said. "He had to learn the hard way."

What about the training of the plant's workers? Certainly, the Athens plant finds itself looking for or training more specialists -- technicians, maintenance workers and electricians with an electronics background. Eventually, too, the plant may need in-house tool-and-die makers to work with more complex, plant-designed automatic equipment.

In general, workers on the shop floor have become better educated as the manufacturing process has become more sophisticated. Workers are being asked to make finer measurements and follow more detailed specifications, and therefore they need sharper math skills. In response, the company has sponsored several in-house refresher courses. "Math is involved in everything we do," Simmons says. "And with SPC and other quality control improvements, it's only going to increase."

Today, about 90 percent of the Athens employees have at least a high school certificate or an equivalent. (In the county as a whole, 57 percent of the population 25 years old or older have 12-years of education or more.) No one has been hired with less than a high school degree in several years. Indeed, there are several college graduates among the hourly workers -- reflecting the lack of high-tech jobs in Limestone County and, perhaps, the highly competitive Steelcase wage that keeps them from leaving home. Simmons says they are both a problem and a blessing.

Some of them are overqualified and without challenging work, become dissatisfied. On the other hand, the fact that Steelcase has some very bright people is one reason they have not had to go outside to fill more of the new positions. Danny Locke, the robot

operator, had two years at the local technical college -- experience that he says predisposed him to taking on the robot challenge.

The Community/Technical College -- The Missing Partner

Limestone County has two public colleges -- Athens State Community College and Calhoun Technical College. Steelcase employees are familiar faces at both, taking business courses or completing associate degrees at Athens State or electronics or other technical courses at Calhoun -- all at company expense.

We'll pay for [education] if it can be seen to help them on the job," Simmons says. "We prefer in-house training, supplemented by instructional facilities." Calhoun lacks the resources to remain up-to-date with all of the new automated equipment the various local plants install -- including rollforms and robots. Consequently, they are unable to do equipment-specific training. Simmons says, "we're advanced ahead of what they're teaching." "They can teach the book portions, the theories, but for hands-on they don't have the equipment. We have one fellow in an electronics class over there. He's learning the theory but he's practicing on our equipment."

Nevertheless, to some extent, automation may be expanding the potential contributions of the technical college. Calhoun Tech is offering courses in Statistical Process Control (SPC), team decision-making, just-in-time inventory, and other concepts related to automation through its new *Alabama Center for Quality and Productivity*. The faculty taught a course in SPC to a group of managers at the plant in 1986. And Simmons and the college recently worked out a program for maintenance workers that includes units in Math I and II, industrial blueprint reading, mechanical drives, precision measurements, and applied physics.

The large GM plant, which has helped pay for the center, has put almost 2,000 of its workers through courses in statistical analysis and sampling, taught by center faculty on-site. Area vendor firms, many of which have been required to use SPC by their clients, are putting people through it, too.

James Chasteen, Calhoun Tech's president, says some companies still feel that education has nothing to offer them. Industries decided a while ago that they had to do a lot of training on their own. Now you see them turning back to schools, particularly to

two-year institutions. They're seeing we can do some of those things as well as they want them done....I can assure you that we can enhance their product and their bottom line."

Conclusions

Two young managers were were taking a rare moment to philosophize, sitting in the main office in a cubicle framed with Steelcase panels, away from the din of the plant. The office doubles as a showcase for the elegant office furniture made across the country by Steelcase.

Automation, they agreed, was inevitable. The company needed it. Competition demanded it. But what would it mean to the workplace? "I don't think it's going to make that much difference," said one, a manufacturing engineer who had been with Steelcase since it acquired the Athens plant in 1979. At that time he was a quality checker on the floor.

"Sure, automation is going to take some power away from everybody," he said. "That's in the nature of the thing. But the workers' responsibilities are exactly the same. They're still responsible for the quality of their parts, just as they are now."

His colleague, the engineer who was recently hired from outside to work on automation and new quality control procedures, took a more open-ended view. "The operators become more responsible for the product at the point [of automation]," he said. "And with new quality control processes like SPC that are coming on, he starts using his noodle a little bit. The operator gets more responsibility and authority. It's a higher level mentality. It goes back to the design of the human interface. The operator is our best source of information in coming up with new concepts."

The discussion mirrors the debate going on in business journals about the impact of automation. Is it increasing skill requirements or de-skilling jobs? Does it create open-ended or dead-ended career tracks? Steelcase's experience with automation so far has yielded contradictory answers to those questions. Task complexity and responsibility have been expanded for the rollform operators.

If there is a clear lesson from Steelcase's experience, it is that automated equipment cannot be treated as just another piece of mechanical machinery. Getting it to work -- with

the commitment of the work force -- requires teamwork and intensified communication between management and labor and a responsiveness to shifting responsibilities. Success will depend on just how the human interface is defined.

Steelcase appears to have several things working in its favor as it adopts new technology. One, its pay incentives and tradition of respect for its employees have created an atmosphere in which workers feel they are secure and have a common stake in solving problems. Generally, despite some early tensions, automation is perceived by floor workers as their challenge as well as management's. Second, the plant's pool of better-educated workers may be more flexible and adaptable to the new technology than workers who are less-educated or tradition-bound.

And, paradoxical as it may sound, something else may help the Athens plant as it evolves into its new shape -- that old, farm-bred work ethic. "Agriculture gives you a mechanical aptitude and a flexibility," says Durham, the industrial recruiter. "Coming from an agricultural background, you've learned that you can't get wrapped up in doing things the way they've always been done. "And these are plainspoken people and that helps to get through your transition. As everyone has learned, your best information in utilizing high tech comes from the people on the front line."

CASE STUDY VI

INTEGRATING PHILOSOPHIES:
CALSONIC MANUFACTURING CORPORATION

by Carol Griffee

Introduction

Japanese-owned Calsonic manufactures motor vehicle heat exchange and exhaust systems. It located in Shelbyville in mid-1983 to be a supplier to the new Nissan truck assembly plant at nearby Smyrna. Calsonic is growing rapidly and is providing parts now to Mazda, General Motors Corporation and the Ford Motor Company as well as Nissan.

Because it is young, Calsonic is heavily automated -- about 85 percent, with robotics and numerical programmed machines. In February, the company added two computer-aided design systems to eight stations as it moves towards computer integrated manufacturing in three to five years. State-of-the-art, however, is a moving target, and at the same time the Japanese are developing even more advanced flexible manufacturing systems.

Calsonic pays better than average wages in the area. The most striking features about Calsonic are the emphasis given to quality and the use of quality circles that appear to make its workers "excited" and challenged by their jobs.

Background

Say "Nashville," and images of Eddie Arnold, Loretta Lynn, Dolly Parton and the whole Grand Ole Opry soar into mind. The Tennessee capital has put considerable energy into making country music a major industry, one that also gives the city a legitimate claim to hemispheric fame.

Located 53 miles to the southeast of the booming Nashville area is pastoral 753-square-mile Bedford County and its seemingly sleepy seat of Shelbyville. However, on a 26-mile drive on Highway 231, going south from Interstate 24 at Murfreesboro, a series of neatly-fenced farms reveals that Shelbyville is not without its own unique claim to fame. It is the nerve center of the world that revolves around the Tennessee Walking Horse, a fact Shelbyville marks annually with a "celebration" that attracts thousands to watch the breed's top specimens compete for massive, multicolored rosettes and other honors.

Another distinction the locals are quick to point out is that Webb School, one of the premier prep institutions in the country (some say second only to Groton), is located in the Bedford County community of Bell Buckle. The public schools are not considered strong. Per pupil expenditures ion the district last year were only $1,762 -- 76 percent of the state average and less than half of the national average figure.

Shelbyville was discovered early in the century by the pencil industry, and its presence remains strong there with eight companies employing 2,000 workers. Raising Tennessee Walkers and making pencils are potent industries, but they don't feed enough mouths in a county that had an estimated population of 28,700 in 1985. Bedford County realized this four decades ago and produced a chamber of commerce that was vigorous enough to construct its own spacious and modern headquarters 20 years ago. The Chamber pursued diversification of the area's industrial base, which led to the location in Shelbyville of such firms as American Can Company (plastic containers), Eaton Corporation (truck transmissions), Stanley Tool (hammers and chisels), Tyson Foods (poultry processing), and Josten's (engraving, printing, and Superbowl rings).

The apparel industry has had a major presence in Shelbyville since the early 1900's. Woodway, a division of the Bailey Company, made private label bluejeans there until the plant closed in November 1985 -- one jump ahead of bankruptcy, according to its former president, Scott H. McDonald. The closure was caused largely, he said, by third-world competition and put 330 Tennesseans out of work.

Woodway's closing caused Bedford County's unemployment rate to rise to almost 13 percent . The unemployment rate didn't stay at 12-13 percent for long because Shelbyville had a "cushion" in Japanese-owned Calsonic Manufacturing Corporation, which opened its doors in the early summer of 1983 with 50 employees. With Calsonic's arrival, there was a perceptible economic revival in the community, Shofner said. The statistics bear out his observation. By September 17, 1987, Calsonic had 590 employees and was adding more each week. Bedford County's unemployment rate today is 8.5 percent -- still too high to satisfy McDonald, who became executive director of the Shelbyville-Bedford County Chamber of Commerce when he finished liquidating Woodway in October 1986.

Recognizing that the availability of a suitable building can give a community a six-month edge on competition, Shelbyville has two new industrial buildings beckoning potential occupants -- one privately built on speculation and the other put up by the local Industrial Development Board. McDonald said he is working with six industrial

prospects. Bedford County's current unemployment rate, as unacceptable as it is to McDonald and others, is still much better than the 20 to 23 percent experienced by other, more rural counties just to the west.

Shelbyville has lost two industrial prospects in the last six months, McDonald revealed, because some localities are "so hungry for jobs" that "they'll tolerate things we won't," as in leasing $2-per-square-foot buildings at half price. "We're not that hungry," he intoned.

The Coming of Calsonic

In 1979, it became generally accepted that American automobile manufacturers would have to do something to blunt the growing resentment and protectionist sentiment in the United States and in other countries whose domestic industries were being drubbed by Japanese imports. Tennessee, as well as many other states, began courting Japanese auto makers. As a result. 11 Japanese-owned industries already were located in Tennessee when the announcement came in 1980 that Japan's number two auto maker, Nissan, would build a $500 million pickup truck assembly plant on an 825-acre tract at Smyrna. Nissan officials said the plant, reputed to constitute the largest Japanese investment made in America to that point, eventually would produce about 156,000 trucks a year and employ some 2,650 people.

Why Smyrna, Tennessee? After all, Shelbyville was larger by 4,000 than Smyrna, a small town of about 9,000 nestled in the northwest corner of Rutherford County some 20 miles southeast of Nashville and four miles east of Interstate 24.

Local legend has it that the Smyrna site, dairy farmland at the time, was spotted by a Nissan executive from the window of a touring car. In addition to being so near to an interstate, the site was only a matter of yards from a main line of the Louisville & Nashville Railroad. According to Nissan officials, Smyrna was chosen over similar competing sites in Georgia because it was more conveniently located with respect to the center of the American market and the port cities of the West Coast. About 60 percent of the parts to be assembled at the plant ar forwarded from these areas.[1]

To attract the plant, Smyrna had promised, among other things, to expand its fire department and to build a $1.5 million gas line; Rutherford County gave the company a tax

[1]Lenehan, Michael, "A Japanese Auto Maker Finds a Home," *Atlantic*, December 1982; p. 12+.

break worth at least $10 million (and maybe much more), and the state contributed $7.3 million to train plant workers and more than $12 million for new roads, including a four-lane connecting highway to Interstate 24.

No official attempt was made to project the number of additional jobs that would be created by satellite factories, but the number was expected to be considerable because Nissan receives component parts according to the "just in time" (JIT) delivery system. Under that system, suppliers accept the responsibility for inventory by agreeing to deliver parts on short notice and only as they are needed. Proximity to the plant is therefore important. Hoover Universal, a Michigan-based company that already had three factories in Tennessee, built a fourth in Murfreesboro to supply seats to the Nissan plant. Hoover has two assembly lines that communicate by computer to Nissan and Hoover delivers finished seats about once an hour. Windshield wipers come from a Tridon plant that already existed in Smyrna. Windows are made at a Ford glass plant in Nashville.

Japanese firms, however, tend to bring many of their suppliers from Japan with them. Therefore, Bedford County did not have time to nurture resentment of the adjoining county's good fortune or have feelings of being "left out" before it learned that it had landed a major supplier, the Calsonic Manufacturing Corporation.

Nihon Radiator Corporation owns Calsonic and often follows" Nissan to supply two families of motor vehicle parts -- heat exchange and exhaust systems. The first family includes radiators (its are state of the art with aluminum cores and nylon tanks, according to Quality Assurance Manager Geary Trussell), air-conditioner condensers, air-conditioner evaporators, auxiliary transmission oil coolers, engine cooling fans, heaters, and the actual cooling unit in an air-conditioner. Calsonic makes the entire second "family" -- that is, the entire exhaust system, including catalytic converters and mufflers.

Trussell, who has been with Calsonic three and a half years, said the original intent was to supply Nissan, but the situation is "really mushrooming ... the customer base is expanding ... I really didn't think it would expand this quickly." As of September 1987 -- about four years since the plant opened -- 65 percent of Calsonic's parts were being delivered to Nissan, about 15 percent to General Motors, 15 percent to Mazda, and 5 percent to Ford. The opening by Mazda of a plant at Flat Rock, Michigan is expected to cause Calsonic's business to skyrocket. "The market is ripe for good quality parts and components delivered on time, just in time, at the lowest possible costs," Trussell said.

The market is so ripe, in fact, that Calsonic managers are noticeably harried as they push for the opening in December of a 168,000-square-foot plant on the 31 acres that the company bought in the new industrial park across town. It will house the exhaust system part of the operation, which now is in cramped quarters.

Calsonic also has had to rent a warehouse for finished goods, and Trussell said the three buildings on the original plant site were "bursting at the seams" with the components it uses to manufacture goods. Another manager, Process Engineer Ed Millwood, revealed that because of the weak dollar/strong yen market, Calsonic is looking now for local sources to replace Japan imports.

A native of Decherd, Tennessee, Trussell is an industrial technology and engineering graduate of Middle Tennessee State University at Murfreesboro, where he has lived the last 16 years. His first post-graduation job was with TRW where he got into quality assurance. When he heard of Calsonic's plan to locate in Shelbyville, he approached the firm for a position because he had been "hearing and studying about what the Japanese were doing" and this was an opportunity "to learn about a better way of doing things." But that's getting ahead of the story.

The five-member Shelbyville Industrial Board, agreeing to act as an arm of the city, made its way through a maze of paperwork to pave the way for Calsonic to locate there. To begin, the Board borrowed $700,000 (mostly from the three local banks) to buy two tracts of land totaling 66.9 acres, construct a building to Calsonic's specifications, and remove another industrial building from property the company already had acquired.

Shelbyville made the most of the latter, getting $95,338 from the state to help relocate the building and then converting it into a hangar for the city's general aviation airport. Jim O'Dell, the area's industrial recruiter at the time, said "the whole Calsonic deal is really turning out better than we anticipated because of the funds we are getting [from the state plus $210,000 from the city] for the hangar project."[1]

Calsonic paid the Industrial Board $350,000 when the initial contract was signed in January 1983 and the remaining $608,350 came when the building was completed in a "turnkey" operation. The city reimbursed the Board for other smaller expenses, such as insurance when the building was under construction and $35,000 for a pump to increase

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[1]White, George, "Shelbyville, Calsonic Deal Winding Down," *Shelbyville Times-Gazette*, Shelbyville, TN, May 23, 1983; p. 1.

water pressure at the new Calsonic plant. The Bedford County Highway Department agreed to haul 2,500 tons of gravel and hot-mix to the site -- without charge.

Other creative financing was involved as well. The Bedford County community of Wartrace received a federal Urban Action Development Grant (UDAG) of about $500,000, which became the source of a low interest rate loan to Calsonic.

A Tennessee city may apply for up to $10 million in state industrial revenue bonds unless there is a UDAG involved, in which case the "cap" becomes $20 million, the Chamber's McDonald explained. The Shelbyville Industrial Board was prevailed on at first to pledge to seek $10 million in state industrial revenue bonds for the Calsonic project.

Before Calsonic and the city actually signed the contract in January 1983, however, the company without explanation had the Industrial Board modify its pledge on the industrial bonds to $1 million. O'Dell commented this apparently was for tax purposes, but Shelbyville City Attorney Hoyte Adams speculated Calsonic might form an affiliate company to make additional bond requests. "They don't do business the way we do. You've got to be patient," Adams told the Board.[1]

Since coming to Shelbyville, Calsonic has been "very careful not to reveal" its total investment, McDonald said. Asked for his estimate, McDonald said after a long pause that an "educated guess" would be "at least $50 million." He refused to speculate any further.

Shelbyville was willing to go through the complicated transactions necessary to gain Calsonic because, Adams said in 1983, it was "an important opportunity" for the city. Although the plant initially was to have 50 employees, "we have the opportunity to have at least 500 people working out there," he said at the time. With 590 employees now,Calsonic is projecting to go as high as 1,200!

Automation: A Never-Ending Cycle

When Calsonic opened its doors in mid-1983, it was simply a receiving station for components and finished goods shipped from factories in Sano, Gunma, Atsugi and Kyushu, Japan. The items were "warehoused" at the Shelbyville facility and received minor inspection before being repackaged and forwarded to Nissan at Smyrna.

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[1]West, Mike, "Path Cleared For Calsonic," *Shelbyville Times-Gazette*, Shelbyville, TN, January 7, 1983; p. 1.

The Shelbyville plant's first production line, one for condensers, was being designed and built in Japan during this period. Twelve technicians (all hourly Calsonic workers on production lines are called technicians) were sent to Japan for 6 to 12 weeks to learn how to operate the equipment. The technicians trained others -- including some of the managers -- when they returned to Tennessee. This pattern of sending American technicians to be trained to operate the equipment has been repeated with every new line added at Shelbyville.

There are now nine production lines in one building at Calsonic and lines for heaters, blowers, cooling units and injection molds in another. Ed Millwood, manufacturing process engineering manager, defines automation as "the process of using equipment to do a required job more effectively and more efficiently."

Millwood came to Calsonic as a process engineer three years ago after a 10-year career at Caterpillar that began as an assembler when he was studying engineering at Milliken University. He soon became senior process engineer at Calsonic, then assistant manager, and was promoted to manager.

Millwood explained that young engineers have a different definition of automation because they are coming into workplaces that generally already have been automated by his definition. Their definition, he said, is "improving automation," usually by adding more sophisticated computerization. But by Millwood's definition, Calsonic is 85 percent automated, which he said is "probably higher than the industry average because we're a young company." A lot of older companies, he added, "can't automate until their equipment is obsolete."

Much of the equipment on Calsonic's production lines fall into two categories. One is robotics -- machines that do spot welding or perform "pick 'n' place" tasks, such as putting converters on a conveyor belt. These machines run on programs developed in Japan. The other category consists of a variety of numerical control programmed machines that shape and install parts. An example of this is a machine that is programmed to cut the fins that go into a condenser at different lengths.

Most equipment has arrived at Calsonic in phases, Millwood said, and "each line's equipment has gotten better through the Japanese constantly striving for improvements." For example, the first line's braze oven was a "straight-through loader." That is, the

product came in one end and out the other, and the doors at each end were always open, creating a constant amperage drain.

In the braze oven on the evaporator line, operational since December, 1986, the product enters and leaves through the same door that opens and closes as needed. Inside the oven, the product makes a series of 90-degree turns and goes up and down elevators, moving through doors during its travels that open and close as needed. Millwood said the new oven is "much more efficient in the use of electricity and nitrogen."

In large part, Millwood said, equipment improvements stem from the ideas of the workers themselves, and he likes it that way. "I can physically run a lot of equipment, but I'm not proficient enough to reach their production levels. The hourly technician who runs the job should know more about it than anybody else. That's my philosophy. By involving these people in defining their problems and letting them come up with the solutions, it gives them a sense of loyalty to the company." American companies, Millwood continued, will send an engineer or executive to the line to locate problems rather than relying on those who work with the machines.

Millwood didn't go to Japan for training until about the fifth production line, but he showed no sign of resentment. To the contrary, "It made it much easier for me, because I was busy here putting in the equipment," he said. Millwood does not believe the Calsonic system would work if it had been superimposed on an existing American Company because "people are so afraid of change, even if it's for the better." This is human nature, not just an American trait, he explained, but the Japanese send the message of adaptation to change through their culture by making the company number one in the lives of employees. If the change is reasonable and the company says its necessary, then the Japanese will accept it, Millwood said.

About 15 Japanese engineers and managers work at the Calsonic plant at any given time. None is assigned to Millwood's section, but he works with them, and he said there are no major differences between American and Japanese engineers -- "mostly small ones." As stated, the Japanese put their companies first whereas "Americans put their families first," Millwood said. "We are professionals...we have responsibility for our jobs whether it takes 8 hours or 16 hours, but we also have family and a social life." At the same time, Millwood said it is a myth that the Japanese stationed in America work all of the time even though they often come to the plant at night. Remember, Millwood cautioned, that it is at

night that the Japanese can communicate with headquarters at Tokyo because of the time difference.

Vice President of Production, Mr. Akira Ishihara also minimized differences between Japanese and American workers. While agreeing that in Japan office workers may work harder than American office workers, he said it was not true on the production line. Calsonic's production workers, he said, work very hard and readily agree to overtime when it is necessary. There is a fundamental difference between the Japanese and American workers, he pointed out. The former are continually thinking about how to do what they are doing better, even as they work. He did not think this was true of the typical American worker, although the quality circles were helping to change that.

Millwood said his process engineering section is beginning to use computer-aided drafting to "lay out production lines." Beyond that, Millwood was vague about the CAD system, as was Jim Batcheler, the manufacturing manager. Stan York, the engineering control administrator, explained that Millwood and Batcheler were vague because Calsonic's computer-aided design systems "were only installed in February, and output has been minimal because we've been in a training phase and they're just now beginning to get some visibility." Calsonic has two CAD systems. They can run independently but "can talk to each other," York said. Each system has four stations.

American manufacturers provided the impetus for Calsonic moving into CAD, he said. All three major American auto makers have been into computer-aided design "for some time" and are requiring their suppliers to be able to exchange data bases directly rather than through hand-prepared drawings. For example, York said, Chrysler wants to send the dimensions of its products on a magnetic tape, and Calsonic then can design a radiator to fit into the area for that part. Calsonic is bidding to become a Chrysler supplier.

York envisions many benefits from CAD. "We see CAD systems being able to communicate designs on 3-D models to our customers and suppliers...We can simulate assembly of products at considerably less expense than building prototypes."

Calsonic obtained its CAD systems from ComputerVision of New Bedford, Massachusetts, which assembles them from several brands of hardware including Hitachi terminals. Nihon in Japan uses ComputerVision, as does a sister Calsonic firm in California. Compatibility of these systems was a principal consideration, York said. "We are looking forward to communicating directly with Nihon eventually," he added.

Batcheler, the manufacturing manager, said no integrated manufacturing was being done at the Calsonic plant at the time. "I don't know whether we can do integrated manufacturing, but I hope we can," he said.

According to York, Batcheler just needs to be patient. The engineering control administrator sees the CAD being totally integrated into manufacturing in three to five years. The CADs are listed now to product and process work, primarily the former. Eventually, York said, information will be transferred into the robotics and test equipment. Asked if Calsonic was aiming eventually for a computerized integrated flexible manufacturing system, York said he was not familiar with this terminology, and claimed that CAD/CAM systems were so new that few engineering schools teach it yet, and this causes most companies to grow "homegrown" CAD/CAM managers like himself.

ComputerVision, the vendor, is providing the training (or most of it) on the CADs at Calsonic. The training has not been easy because "it's so completely different. It takes a long time to learn to use it and then to apply it to our operations...it's a never-ending cycle," York said.

But Batcheler's assistant, Kathy Watson, has not been daunted. She proudly showed a visitor the company's CADs with laser printer. She said the vendor had trained Calsonic engineers to operate the computers but confessed she had learned to use them by quietly slipping into the room during her lunch hour to work on them!

The Magnificent Obsession with Quality

Geary Trussell, Calsonic's quality assurance manager, is absolutely adamant about the point that technology alone --- automation -- won't do the job in today's economy. It must be coupled with management philosophies that largely are or have become foreign to American business. Otherwise, he said, it's like "having a cake without icing."

No one used these precise words and there was no sign posted to this effect, but Calsonic's management philosophy could be summed up in the phrase, "Quality people build quality products." Quality is an obsession, and the commitment would appear to start at the top and at the front door.

Enter Calsonic's main door and one is in a paneled vestibule that serves as a lobby. There are plaques on the walls, but only ones carrying certain messages: the 1985 and 1986 Quality Achievement Award from Nissan, one publicizing membership in the Central

Tennessee Chapter of the International Association for Quality Control, another proclaiming Calsonic to be a 1987 sustaining member of the American Society for Quality Control, and another hailing the firm as member of the Golden Century Club for its "generous support" of the Middle Tennessee State University Foundation, to cite but some.

The Chamber's McDonald relished telling about the time Calsonic's Japanese president, Kentaro Arai, was visiting Mazda's Flat Rock plant and a bracket fell off of a Calsonic muffler. Within the hour, McDonald said, seven Calsonic managers were on an airplane to Flat Rock to answer for this embarrassment. "It was an international event," McDonald said with a grin.

Becoming solemn, he urged the author to "contrast this with the number of times American quality control works to justify shipping something that has failed." The intention of the Japanese, McDonald continued, "is to build the very best they can" whereas "Americans say, 'I'll give you so much quality for so much price.'"

The reader already has been exposed to the management philosophy of Millwood, who attributed Calsonic's rapid expansion exclusively to the quality of its products. The firm's management philosophy, which is carried out through 57 quality circles established two years ago, received a ringing endorsement from Batcheler, who has only been with Calsonic in Shelbyville since October 1986.

An engineering graduate of Lehigh University in Indiana with a master's degree in business administration from Bradley University, Batcheler had read about quality circles before joining Calsonic but had "never had any direct experience" with them, although one of his previous employers, Quality Industries, made limited use of them at its Benton Harbor facility.

About two years before he was contacted by a recruiter for Calsonic, Batcheler had resigned from his position with a small privately-owned residential heating and cooling manufacturer after six months of "gut-wrenching discussions" with management had failed to resolve their philosophical differences. Batcheler and his wife bought and established a dry-cleaning franchise in Murfreesboro that she is now operating.

"I feel strongly about quality circles," Batcheler volunteered. "I'm amazed they're as good as they are; they're only two years old next month. I'm surprised it's matured as quickly as it has. Some of the solutions I've seen coming from them. . .I doubt a graduate engineer could come up with any better." Using quality circles, he explained, "decreases

your need for overhead" because "the engineering talent you have can be used for capital planning -- what kinds of equipment will be needed and when."

The Japanese favor what Batcheler called "flat organizations," which he said means having 50 people reporting to him. "The only way to do this is to have the group made up of self-directed people who are skilled in their jobs. But more than that, they know what needs to be done to make the company successful and will do it without being told and will follow reasonable rules."

Quality circles are working, he asserted, because "people like to be recognized for making a contribution." It gives him great satisfaction, he said, to see the way people "swell up with pride" when they've been told they did a good job during critiques at problem-solving sessions. "I've never heard a technician say they're [quality circles] not worthwhile," Batcheler said, though he went on to amend this, saying that those in the administrative offices apparently aren't as enthusiastic as those in his section.

The Japanese use of quality circles has received enormous publicity. Batcheler said Calsonic has had to modify the concept to make it work in America. In Japan, employees participate in quality circles outside normal working times. "We allow one half hour a week for quality circle work and they're paid for it," he said.

Batcheler believes that American management is becoming "more mature -- less autocratic," but McDonald said Calsonic's management style has not yet spilled over into any other Shelbyville industries. McDonald, however, is as down on American management (although he's a product of it) as Calsonic's managers are high on the use of quality circles.

Management backed by "ignorant shareholders" are "clearly" the culprits in America's industrial decline in McDonald's eyes. McDonald, who holds bachelor's and master's degrees from the University of Tennessee at Knoxville, said, "We got into a mess through professional management -- people who didn't have a stake in the company but only in their careers." These managers, he said, often were picked too quickly for jobs that were unrelated to a company's products and services. They were trained in "dynamic deception" and rewarded by the system that created it. Once in those jobs, McDonald continued, the managers "didn't put anything into training or equipment upgrades because they wouldn't show in the bottom line" and wouldn't satisfy shareholders' desire for quick profits. The Japanese, he said, are more concerned about the long-term health of a company.

Asked if this wasn't the fault of American schools of business and finance, McDonald said they were only being "responsive to what they expected [their graduates] to find in the real world."

McDonald refuses to put any blame on American workers for industry's decline. Based on his experience managing apparel plants in Alabama and Mexico as well as Shelbyville, McDonald said that contrary to what many may say, "workers have an in-depth understanding of where the money comes from [customers]" because they are consumers as well as employees. It is the managers who lag in recognizing this, he declared.

The Calsonic "Family"

Millwood, the process engineering manager, supervises the work of 24 graduate engineers, 80 percent of whom are industrial engineers. The remaining 20 percent are industrial technology engineers and mechanical engineers. There were two openings in his section on September 17, 1987, and Millwood said he was reviewing 22 to 25 resumes of applicants for the positions. Asked to name a particularly good source of trained personnel for his section, Millwood replied that, "we've gotten some good people out of Tennessee Tech" at Cookeville.

If he had any complaint to make about the quality of engineering as it's being taught in America, Millwood said it would be that there's "not enough emphasis on real world conditions as opposed to theory." Calsonic is attempting to remedy this by "cooping" -- that is, it has had four student engineers work at the plant during the summer or on internships.

Quality Engineering

Trussell, the quality assurance manager, supervises 53 persons. Six of those are quality engineers with degrees in mechanical, industrial or electrical engineering. They work directly with Calsonic customers and write the standards for new processes to make the products that they want to their specifications. These are the engineers, Trussell said, who "have a chance to say 'this won't work' and bring the idea people down to earth."

One engineer and seven technicians within Trussell's section are engaged in functional testing in two laboratories where, he said, "we shake 'em, bake 'em, and try to see if they'll [the products] fail." A new and highly sophisticated area of testing that

Calsonic is entering involves using computers to simulate field conditions in the laboratory for the products. This will eliminate the need to test the products on motor vehicles or tracks.

Trussell's seven technicians have associate degrees, primarily from Nashville Technical College and Motlow State Community College at Tullahoma, a city located 16 miles southeast of Shelbyville. The training these graduates received could be a "tad better," Trussell said, but he conceded immediately that, "It is difficult to train people for the kind of specialized testing we do." Those with backgrounds in electricity, hydraulics, pneumatics or mechanics will fit in here, he added.

It's "tough" to find people with direct training in testing, Trussell said, and it would help if the community colleges would incorporate some of this into their curricula. Meanwhile, Trussell is now scouting the Detroit area for persons with testing experience.

The third of the four groups under Trussell's direction is comprised of 26 technicians, most of whom were hired from the local community. They receive and inspect the raw materials and two million components -- the aluminum and steel, the tubing, nuts, bolts, screws and brackets -- that go into making Calsonic products.

Others in the group audit the actual production, checking among other things to make sure an operator's machine is on the proper settings and at correct temperatures. Many in the original group had quality control experience gained at a Shelbyville tire plant (Uniroyal) that had closed. A few with quality control experience came from other Shelbyville industries such as Stanley Tool and Eaton. The technicians have high school degrees plus training provided at the plant, if they have had no previous experience.

Also under Trussell's direction is the five-member Metrology Group, metrology being the science of measurement and instrumentation. Their job is to answer such questions as, "Does this tubing have the right amounts of zinc and iron?" They use computers and a scanning electron microscope to measure chemical composition. The company is in the process of buying a mass spectrometer for the group and two more laboratories are being constructed to accommodate Calsonic's exploding growth.

Three of the five in the group had metrology experience gained in other jobs. Three of the five "had little experience in computers" and received training from the vendor, Brown & Sharp of Massachusetts (the hardware being Hewlett-Packard). It would "be an asset" for anyone in this field to "have basic computer knowledge," Trussell said. The x-

ray technician in the group -- one of the three original hirees -- received two and a half weeks of formal training in Chicago on the machine, provided by the vendor.

Trussell does not foresee hiring engineers from doctoral-granting, research higher education institutions such as Vanderbilt University at Nashville. "We've got the mud here, and we're making the pies," he said, and it's his impression that graduate engineers from such institutions don't want to get their hands dirty in the middle of the mud puddle.

At the top of Trussell's "wish list," however, is a school at his alma mater, Middle Tennessee State University, for quality engineers and the improvement of its industrial engineering program with a bigger staff that would allow it to "get into things like robotics."

New Horizons

About 300 of Calsonic's workers were involved directly in manufacturing as of September 17, 1987. Some 80 percent of the first 100 hired three and a half to four years ago, came to Calsonic from other area industries, Batcheler said. There was a higher percentage of "high schoolers" (graduates and dropouts) in the second one hundred hired.

Calsonic changed its hiring method in late 1986, coinciding with an influx of orders from the Ford Motor Company and General Motors Corporation. The company is committed to a "no layoffs" policy, Batcheler explained, "yet we were not confident of Ford's and GM's ability to predict their needs." Therefore, it was determined to be in Calsonic's best interest to hire temporary workers, which it did through a private recruiting firm, New Horizons.

The arrangement provides for each New Horizon employee to work at Calsonic for up to 480 hours. The theory is "if we kept them this long, we probably would have a need for them on a permanent basis," Batcheler said. In addition, "it gave us time to observe their [work] habits with no strings attached." At 480 hours, Calsonic has the option to ask a person to go on permanent status at the plant, though technically the individual remains a New Horizons employee.

"The supervisors had some serious doubts at first, but this has worked out well," Batcheler continued, and all production people are now New Horizons employees for all legal purposes, but their hearts, identities and their work belong to Calsonic. The majority

of Calsonic workers, both those on the production lines and the staff engineers (excepting American managers) observed by the author, were wearing blue Calsonic uniform shirts.

Concern About Unions

Tennessee is a "right-to-work" state and there is no labor union at Calsonic. Shofner, the Shelbyville newspaper editor, said his community had "never been big on unions." But Calsonic managers are noticeably worried about any possibility of union activity at the plant. The Chamber's McDonald referred to the concern as "near-paranoia." He speculated that Calsonic feared it would be only a matter of time until the United Auto Workers made a run on its Shelbyville facility. McDonald believes further that the real reason Calsonic chose to locate its new exhaust system production plant across the city from its existing facility was to make an organizing effort more difficult. The company's official explanation, he said, was that its management philosophy worked better with 500 employees rather than 1,200 at one plant.

Millwood said the Japanese are more "people-oriented" than the American factories he has observed and in which he's been involved. Rather than being reactive, they appear to work at maintaining high worker morale. For example, although Calsonic is non-union, all non-management job openings are posted and workers are encouraged to apply for them, Batcheler said.

The United Steelworkers are the bargaining unit at Eaton in Shelbyville. The starting average hourly wage is $8.98 there. Eaton is the highest paying industry in Shelbyville, McDonald said. Calsonic's average hourly wage is $8.17, which he said was about $2 above the average hourly rate for Bedford County.

It's the Attitude That Counts

According to the 1980 Census, less than half -- 48.5 percent -- of the 16,977 persons of 25 years of age or older in Bedford County had completed 12 or more years of formal education. Reminded of this statistic during an interview, Batcheler, 40, rejoined that, "I'm looking for attitude rather than educational level" when hiring. A good attitude, he elaborated, is "someone who expects to work for a living, who is task-oriented, and cheerful about it." Calsonic has not encountered any shortage of such people "that I'm aware of," he said.

Batcheler continued: "I've got a couple of older guys -- I guess you might call them 'shade-tree mechanics' -- who are very creative, but they can hardly write." At another point, he recalled a man who struggles to read his "crib cards" when making a report in quality circle, "but he sure can operate that machine he's on."

Told in a separate interview about Batcheler's remarks, McDonald said, yes, he had heard these "oft-repeated" stories about the abilities of older workers, but that they were not realistic assessments of the times. "In mine and previous generations, there were plenty of poor people who were highly responsible. Take my grandmother for instance. She repeated the eighth grade four times, not because she couldn't pass but to go on to high school would have required her folks to pay for boarding school, and they couldn't afford that. It was a function of availability, so she repeated the eighth grade four times, each time the teacher finding new materials for her...today she's as bright and capable as any 81-year-old I know."

"In today's economy," McDonald continued, "there does happen to be a high correlation between being poor and being irresponsible, and even -- I hate to say this -- between being criminals and being poor." When pressed to justify his attitude-over-education position, Batcheler revealed that he really is of two minds on the topic. He conceded that, "sophisticated equipment has to be run by reasonably sophisticated people" and that it probably would be impossible to operate the robots on the catalytic converted line "unless you can read and write."

Asked to assess education in the area, Batcheler responded he has two sons, aged 20 and 13, and he judged by them that "Tennessee has quite a bit in basic skills and I just hope they follow through." Follow through? "Make sure people coming out of high school have basic skills." In addition, he would like to see computer literacy fully integrated into the public schools in every subject at every grade.

Moving to the subject of vocational-technical education, Batcheler said Calsonic reimburses 100 percent of the costs for an employee who takes a work-related course at a nearby area state vocational-technical school and "I personally encourage this." Two or three have done this and one worker is enrolled now. Calsonic has "a pretty strict absenteeism policy," he said, but has made an exception for this young worker to attend the school. As to other relationships with the institutions, Batcheler noted that the state has provided the facilities and instructors for welder training (robots do not do all of the welding at the plant). Graduates of the course "are not fully trained," Batcheler said, "but

at least they have an understanding of the equipment." On the whole, Batcheler said he was "very impressed" with Tennessee's effort to recruit industry, especially compared to his previous state of Illinois, which he called "industry alienated."

McDonald said the state's chief role in spurring economic development was to provide improved education and roads. He is unsatisfied with the vocational-technical schools, but said societal attitude was the source of the problem. "Our big role is an educational one -- preparing people who can work in an automated workplace," McDonald declared. "We can do this, but we need to continue to focus on education both academically and vocationally."

The vocational-technical education system needs to "try to make sure nobody sifts out of the system with zero skills. Vo-tec has a key role to play, but it does so without a lot of respect...vo-tec education is horribly misunderstood in this state and country. It is not a catch basket for incompetent and bad people; it is a way to maximize the development of skills of certain people."

Some people, he said, are naturally capable at such things as mechanics. His dad was one, but there were "certain things he didn't know about" and he couldn't repair one of today's modern cars anymore than McDonald could. "I can fix a typewriter," though the Chamber executive said with a grin, -- "if it's old enough."

The best place for naturally capable people to round out their skills is in vocational-technical schools, he said, although the community college may be better for others who want to get deeper into such matters as circuit design and microcircuit logic.

Shofner, Shelbyville's young newspaper editor, is disturbed about the low education support he sees in the community. Murfreesboro's schools are reported to be superior to Shelbyville's. "Education appears to have a lower priority...there's no hue and cry to improve the school system here," he lamented.

Just that day, in fact, the lead article in Shofner's newspaper was a report of how the Bedford County Commissioners had failed to override the county executive's veto of their $100 assessed value school property tax rate and had set a new school rate of $1.63 as part of an over-all county rate of $2.90.

Therefore, while the school system budget was being increased 21 percent, the county general fund -- containing all county budgets except schools, roads, solid waste and

debt service -- had been increased by more than 52 percent. Commissioner Eugene Ray complained that the education department invariably comes in the county's last of priorities.[1]

What is the top priority of Bedford County's residents? "They are most concerned about maintaining their current lifestyle," Shofner replied. Do they not see a connection between education and maintaining their current lifestyle? No, he replied. How can the connection be demonstrated to them? "You've got to show 'em," he said, "because people don't and won't make changes until they're near disaster."

The Japanese families, however, continue to support and use the public schools. Eight Japanese children are enrolled in the elementary and middle schools. They knew no English when they arrived, according to Vice President Ishihara, but he was pleased with the help they received from good teachers and their progress. His advice, however, was to rely less on schools and employers for education and become more interested in "self-improvement."

Working for Calsonic: Three Employees

Jeff Hittson: Settling Down

Jeff Hittson did something he shouldn't and was going to get "whipped up on" for it. "I figured I didn't have to take that," he recalled, so Jeff dropped out of Bedford County's Cascade High School -- three months shy of graduation.

Jeff came to work at Calsonic in October 1984 and welded mufflers for a little more than a year. Now he loads catalysts into their bottom shells, puts on the top shells, and inserts the whole unit into a machine that spot welds the shells together.

At first Jeff classified the machine he operates on the catalytic converter line as "medium technology." Then he got to thinking about that. Sometimes the machine will go three or four days without a problem; then, "When it tears up, it's a booger to fix," as when one of the two dozen or so limit switches gets jarred out of place. Usually he can find and fix the problem himself. If not, he summons the lead person on the line.

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[1]Carney, John, "Commission Changes Mind," *Shelbyville Times-Gazette*, Shelbyville, TN, September 17, 1987; p. 1.

The lead person is the one who taught Jeff to operate the machine -- and all the others on the catalytic converter line. It took "about a month to learn a lot" about the machine. He likes this job better than welding mufflers. It's a cleaner job and "I don't know how or why it's more challenging, but it is, and I like a challenge." In fact, "I like fooling with machines, always have -- used to rebuild old cars," he said. Has he ever thought about going to the vocational-technical school to hone his mechanical skills?

"Yeah, I've thought about it, but that's all I've done -- think about it." How come? He almost smiled. Now 22, Jeff revealed that he married three months ago, and he's still in that process called "settling down."

Rita Williams: No More Wet Feet

Rita Williams dropped out of high school in the tenth grade to marry. Still in her early 20's and as lively as Jeff is quiet, Rita is now the twice-divorced mother of two. To help support her family, she stood for two years in cold water, packing chicken breasts on a poultry processing line. Tired of wet feet, she went to Woodway, the firm that made private label bluejeans until it closed in 1985. There she inspected jeans for five months, sometimes clipping errant strings. That was boring.

Rita joined Calsonic two years ago, starting on the blower line in Building 1. There she inserted screws in a machine that descended and with air pressure, drove the screws into the blower units. She moved to the cooling unit line eight months later where the lead person showed her how to test the products for leaks. The units, containing charged gases, were put into a chamber for 20 minutes. If a buzzer sounded, the unit was leaking. "It was not really complicated," she said.

A notice went up that there was an opening on the evaporator line. She "bid off" for the job because it paid more money. Now Rita is operating six machines at the same time; three of them are "benders." These machines take tubes and bend them into the shape of an evaporator. These units then go into a "reformer" that uses 100 pounds of pressure to leave "exactly the right amount of space" for fins to be inserted later by another technician. These machines are already programmed, so Rita only has to punch the appropriate buttons. After an automatic saw trims the ends off the tubes, the tubes enter a degreaser, which is a basket filled with a hot solvent. When the the tubes come out of the degreaser, they are ready to go to the "end sizer," which "crimps" the evaporator's ends and blows air through it to remove any loose metal shavings or other debris.

If a red light comes on and a buzzer sounds at any point -- well, that's trouble. The machines "ran great all day" the day before the interview, and the line's technicians went home about 3 p.m., having met their quota. Some days a machine seems "to go down every 10 minutes"; in fact, today looks as if it may be a 7 p.m. go-home time because there's trouble on the line.

The technician whose place she took taught her to operate all those machines. She also knows how to work the other machines on the line. Sure, there's more to do, "but I like to stay busy...I like to do different things." When a machine goes down, the lead person or another technician tells her how to fix it. "I'd rather them tell me and let me do it myself -- that way I learn more."

Does she regret not having finished high school or considered returning to get her diploma? "I figure I've got just as good a job [at $8.14 an hour] as any around here who graduated." In addition, it's better than packing chicken breasts or snipping strings on jeans. "The atmosphere...the attitude are better here" than anyplace else she's worked.

Peggy Jones: I Love People

In late spring, Calsonic managers put together a list of candidates to become a second full-time quality circle facilitator for the company. All were interviewed, and a woman who worked on the radiator line was chosen because, Batcheler said, "She identified with people, had a pleasant way, and her answers seemed to be from the heart. She is doing an outstanding job." The woman is Peggy Jones, and this is her story:

Peggy, a petite 51-year-old widow with naturally gray hair worn short, spent 10 years as an underwriter for State Farm Insurance. She was homebound after being injured seriously in an accident, but idleness soon wore thin. Although her husband was never fully supportive of her working outside the home, she found a part-time job at Josten's, the printing firm in Shelbyville. After her husband died, Peggy felt free to seek full-time work and came to Calsonic three and a half years ago. The first time she looked at how fast the heater line was moving and how quickly the technicians had to work, she thought, "There's no way I can do this!"

But she could, and she did learn to pack the heater outlet with insulation in a matter of seconds, and "I was so proud when I learned how." She felt even better when she learned several other jobs on the heater line over the next one and a half years.

A new radiator line was being installed and jobs for it were posted, including one to operate a "clinch machine." She was "real excited" when her bid for the job was accepted, and it actually proved to be easier than what she had been doing though it involved several steps -- putting the core of a radiator in a machine, place an O-ring, and putting the tank on top of it. Then push some buttons and -- presto -- the machine fastened the core and the tank.

"I got pretty good at it" and this "helped me build up my self-confidence -- made me feel like a complete person," she said. This company, Peggy explained, "thinks you can learn anything you want to."

The ultimate in confidence-building in Peggy's Calsonic career came when she learned someone (she suspects it was the firm's other full-time quality circle facilitator) had put her name on a list of candidates to become a facilitator.

Peggy, a Texas native with a high school diploma, was chosen for the post and received a week of training in Atlanta, Georgia, where she said "I became thoroughly confused." Now she is scheduling and helping 26 quality circles while the other facilitator, who had some previous experience in the work and underwent only advanced training, handles 31.

As Peggy described her job, it is to get the members of each circle to "look at their problems" and to ask if there's a better way to do their jobs? "They're the experts. I tell them, 'if you can't tell us, who can?'" She said it boosts the morale of technicians to know that "somebody is listening to them."

Each circle has a leader, so she is not that. Her job is to keep the group focused on its problem finding and solving during the 30 minutes a week it meets and to provide any graphs or other needed materials. The Japanese, she said, call the facilitator a "pusher." Peggy seemed to be so excited about her work that it was natural to ask her if she would ever take another job if it were offered. "It would be hard to decide because I love people and working with them," she replied.

Community Impact: Reserving Judgment

Neither the Chamber's McDonald nor Editor Shofner was aware of Calsonic being a catalyst for management change by other Shelbyville and Bedford County industries.

Calsonic also has not set a new automation standard for the other industries, McDonald said, but this is because "technology itself in comparable industries is what sets a standard, and we don't have any other radiator assemblies here." Shofner knows that Stanly Tool, where he worked from 1979 to 1981, has become more automated, but he doesn't know that any of it is attributable to Calsonic's presence.

Calsonic's major contribution, McDonald said, "has been in providing jobs that are above our average." Bedford County' s median family income in 1979 was $16,098, which was 97 percent of the state's at $16,564 and 80.8 percent of the national median family income of $19,917 for that year. The higher than average wages paid by Calsonic may mean that Bedford County will keep pace with or perhaps even surpass the state's median family income figure in the future.

The company's presence, McDonald said, also has "raised expectations in the quality of life and...services." Shofner agreed with both of McDonald's assessments. "People are aware that automation is technology, and technology is progress...so by Calsonic coming here, people expected progress."

Calsonic arrived at the same time the economy began to pick up nationally, "so it would be hard to say emphatically that it has had a monumental effect" on reviving the area, Shofner continued. But the pace of life has quickened in Shelbyville. So far, however, "there's been more interest than movement -- a lot more people are looking at us. We're seen as a growth area -- where you want to be," Shofner said.

While the state's major role should be to foster a good business climate through its tax structure, improved education and roads, McDonald said, it is the locality's responsibility to provide an attractive community, one in which the services -- water, sewer, power, police and fire protection -- work. McDonald believes Shelbyville has "demonstrated its interest" in industry.

Roads are a concern of manufacturers, McDonald said. Industrial clients want to know "can we get to and from Tennessee easily and economically." The Shelbyville area is asking the state to convert Highway 381 into a four-lane connector to Interstate 24 rather than putting its resources into constructing yet another bypass (Interstate 680) south of Nashville. Further, only 3.5 million gallons a day of the city's sewage treatment capacity are being used now, and 1.2 million gallons a day of water capacity still are available.

This is not to suggest that conditions are perfect, however. Shofner is young and single. Batcheler's assistant, Kathy Watson, is young and single. They see Shelbyville as "probably a good place" for families, except for the schools, but they complained that it's socially a bore. Shofner spends a large part of his free time in Murfreesboro, a city of about 40,000, which has three nightclubs and liquor-by-the-drink. He said that Calsonic has gone through a lot of managers, and he suspects it's because managers prefer to be in an urban setting than in rural Shelbyville. McDonald knows that about 50 of Calsonic's employees live in Murfreesboro and, in response, is presently working with a group of retailers to try to broaden the availability of goods and services in Shelbyville.

Calsonic's human resources manager contends that employees choose to live in Murfreesboro because they came from there before taking jobs at Calsonic or because they ar young and looking for "bright lights." He had no knowledge of anyone choosing Murfreesboro because it has better schools.

Bedford County residents, 90 percent of whom are white, are "not the most tolerant people," Shofner said., but he still has no knowledge of any racial problems -- either with blacks in the past or with Japanese now. All in all, Shofner said, local residents welcomed Calsonic and there was a strong element of curiosity: Japanese families ar dispersed throughout the city and do not live in an enclave as some critics contend. Their presence so far, according to Moore, has been low key.

Was the Japanese industrial juggernaut a myth or was it for real? "I think they 're still reserving judgment," Moore said.

CASE STUDY VII

MAKING WAVES: *ACME ENGINE COMPANY*

by Marybeth Dugan and Joan Oleck

Introduction

When Acme Engine Company decided to locate its highly automated $350 million plus engine manufacturing plant in rural Washington County in 1980, it was greeted with unprecedented state and local cooperation and support. At the time, Acme, a joint venture of Holbrook Engine Company and Carrier Company, was the most sought after industrial recruit in the nation. Washington County officials faced stiff and sophisticated competition, and they won.

But Acme brought with it more than just new technology. It brought along radically new concepts of work organization. It brought along new ideas about training and skill development. It brought along black, middle class managers unaccustomed to being denied membership in country clubs. It also brought along a long history of corporate responsibility and philanthropy -- through the Holbrook Foundation -- in the communities in which Holbrook plants are located.

The following case study raises issues about how southern communities and work forces, accustomed to agriculture and light manufacturing economies, adapt to heavy, highly automated, precision manufacturing. It also raises issues about how effective the industrial recruitment of large manufacturing facilities is as a community economic development strategy.

A Community Profile

According to the 1980 Census, the Town of Oakdale had a population of just over 900 people, two less than were counted in the 1970 Census. It is not exactly the kind of place one expects to find the fifth largest industrial investment ever made in the state. In fact, Acme Engine Company is not there; it is located just outside the town on county land,

between two small, low income,but well-established black communities, Appleton and Howard Heights.

Robert McBride, planning director for Washington County at the time of Acme's arrival, remembers trying to convince Acme's two parent companies that the area, which includes the City of Rolling Hills, could support a highly automated precision manufacturer. Acme lies about 15 miles north of Rolling Hills, one of the state's ten largest cities with a 1985 population estimate of about 47,000. McBride remembers the story passed around that Carrier officials looked up the population of Oakdale and said "no sir" to the idea of locating in such a small town. "Carrier viewed us as really out in the sticks....We had to sell them on the idea we were an urban community of 65,000, not just the town of Oakdale."

The city of Rolling Hills is split -- by the railroad tracks that define the line between Washington County to the west and Jefferson County to the east, by geography, and by race. This is important because the city's position as the center of trade and commerce in this region of the state has played a pivotal role in influencing growth and development throughout its immediate environs -- some claim for the betterment of Washington County at the expense of Jefferson.

Population growth rates across the two counties reflect some of the disparities between them. Between 1970 and 1980, Jefferson's population grew by 7 percent, solely due to natural increases, while Washington County's population grew by 14 percent, half of which was due to migration into the county. During the 1970s, Jefferson County was one of only a few counties in the state to experience net out-migration. Since 1970 to 1987, population in Jefferson has increased by a total of 14 percent, while in Washington County it has grown by 22 percent. According to projections, this uneven growth rate will continue through the year 2000, with Washington County estimated to grow almost twice as fast as its neighbor. Although Washington County is more rural than Jefferson, with 60 percent of its population living in rural areas, its urban population grew by 40% between 1970 and 1980, while its rural population grew by less than half of one percent. Jefferson's rural population, on the other hand, grew twice as fast as its urban, increasing by over nine percent during the same decade.

The counties also differ racially. In 1980, Washington County's population was 33 percent black, a decrease from 1970 when its population was 36 percent black. Jefferson County, on the other hand, increased its share of black residents between 1970 and 1980,

from 47 percent to 51 percent. Rolling Hills, which straddles the two counties, is 44 percent black, though nearly two-third's of the city's blacks and 61 percent of the total population live on the Jefferson side of the city. In 1980, the median family income in Jefferson County was only 81 percent of the Washington County median family income.

"When people move here, they have to make a decision," says Susan Perkins, executive director of the local Legal Services office. "Are they going to live in Washington County, or the Washington side of Rolling Hills, or in Jefferson? And most whites move to Washington County for a lot of reasons, including the fact that the real estate people steer them to that part of town." The same is true for businesses moving into the area. Economic growth has been distributed unevenly across the city and two counties. Almost three-quarters of Rolling Hills's total tax base is located on the Washington side of the city; and in 1984, of the 18 major industries in both counties whose tax value exceeds $1.8 million, 11 were located in Washington and seven in Jefferson.

Superimposed on the above disparities are growing tensions over the area school systems. In the two counties there are four systems -- Washington County, Rolling Hills City, Jefferson County and Jefferson City (in Jefferson County) -- each of which has become increasingly segregated over the last 15 years, due to changes in municipal boundaries and population migration patterns. Tensions over the increasingly unacceptable school situation, in turn, have heighten concerns about the economic and racial disparities between the counties. And all parties agree that the situation as it presently exists is detrimental and affecting more than just the schools. Bill Lee, Jefferson County school superintendent, says that the division caused by the schools situation "has been gradually building to where it's become a problem that's affecting us educationally...but equally important, it's affecting us economically. Industry wants us to solve problems like that before they bring their plants in."

In 1984, the executive director of the Rolling Hills Chamber of Commerce, made a similar comment, saying "Word is starting to spread....Our industries are beginning to have trouble attracting people here." Tom Greene, former member of the Washington County Industrial Development Commission agrees, saying, "We have lost several industries that have said they're not going to come here until the school situation is resolved."

Washington County Commissioner Robert Stills, however, disagrees. "We've had the problem with school merger discussion for 15 years. And we've had our greatest

growth in those 15 years, so it hasn't been a negative." Economic growth in Washington County is in part influenced by its proximity to a nearby metropolitan area that has been experiencing dramatic growth since 1970. The local economy reflects the mix of new industry and urban growth to the west on the one hand and traditional rural industries to the east on the other. Textiles and agriculture, principally tobacco, have shaped and remain an important part of the area's economy. Rolling Hills is home to two banks that began as a response to the financial needs of the local agricultural economy, as did many of the local services that exist today. The late 1970s brought inflation and hard times for local industry, and Washington County lost thousands of jobs, particularly in textiles. Today, nonagricultural employment accounts for 96 percent of Washington County's total employment. Manufacturing accounts for 42 percent of total employment, compared to only 28 percent in the state as a whole. The largest employers in the county are pharmaceuticals, food processing, and textiles. Acme Engine currently employs close to 900 people, including all consultants and contracted service workers.

New growth in the area since 1980 reflects a cooperative attempt among local economic development officials to create, or at least market, the idea that their area is an ideal location for firms manufacturing supplies for the nearby high growth metropolitan area to the west. To date few, if any, local firms have established supplier-buyer relationships with firms in the metropolitan area, yet the concept is widely accepted as the guiding principle of the area's growth strategy. The strategy does, however, require an element of regional cooperation among the four participating counties, and this cooperation is a new phenomenon for Washington and Jefferson Counties.

When talking about the disparities in economic growth between the two counties, Washington officials often claim that Jefferson officials have historically been uncooperative when dealing with the City of Rolling Hills, and Jefferson officials agree. "Prior to 1982, the Jefferson County Commissioners were an enlarged version of the Jefferson City Council," says Reverend William Stone. Stone was elected Jefferson County Commissioner in 1982, along with another Rolling Hills black, and together the two men pushed for better relations between Washington and Jefferson Counties. "We were the first Black commissioners since Reconstruction," Stone continues. "We began to treat things differently, to instill upon our colleagues the need to cooperate with Rolling Hills."

executive who served on the county's industrial development commission at the time and who played an active role in wooing Acme to Washington County. "This was going to be the first opportunity to, bam, in one plop, have state-of-the-art everything."

In addition, there were unrealized projections that the engine manufacturer would eventually employ 1000 to 1500 local workers and spin off lucrative contracts and other opportunities to dozens of present and future manufacturing and service firms in the area. Robert McBride, then planning director for Washington County, acknowledges the over-enthusiasm. "I was into that, I overplayed it, too" Don Mahoney, Acme's director of supply, remembers too. "There was a lot of rhetoric and fanfare about the spinoff effect, and that was greatly overplayed from my perspective, I knew it wasn't going to happen, not as people see it."

Something else didn't happen -- the unanimous community support that business leaders expected. There was the local mayor in Oakdale, for instance, who slapped a staggering price tag on a key piece of property Acme needed. There was the City of Rolling Hills, recalcitrant -- from Washington County leaders' point of view -- about an essential water and sewer connection to the plant. Finally, there was the matter of Howard Heights and its twelve homes sitting on land designated by the state for the custom-designed training center that was the jewel in the strategical crown for attracting Acme in the first place. In the local zeal to attract Acme, county officials delayed addressing the needs and concerns of the people of Howard Heights.

"Everyone just wanted to get on with this beautiful future that was going to come down," recalls Susan Perkins, executive director of Legal Services, which in 1981 became an advocate for the 12 families, making sure that their concerns were fairly addressed. When the recruitment effort was at its strongest, Perkins says, "To have raised these concerns and in any way to have suggested that this project could be delayed if not stopped altogether was considered anti-progressive, even anti-development."

The politics that ensued -- between Washington County and the City of Rolling Hills and between the communities of Howard Heights and Appleton and the county and state governments -- to reconcile the situation delayed any holiday celebration in Washington County. Officials at Acme, whose presence was the catalyst for all the ensuing confrontations, found themselves enmeshed in the struggles that surrounded them, and, as will be discussed later, they played an active role in facilitating solutions.

The Birth of Acme

On July 1, 1983, the first four-cylinder engine came rolling off the assembly line at Acme Engine Company, the unique offspring of the union of two corporate giants: Carrier Company and Holbrook Engine Company. Their union began five years earlier when they signed a joint partnership agreement establishing Acme. The partnership is noteworthy for its longevity and strength, one reason being the strength of the two parent companies.

In 1978 when the partnership was signed, a healthy economy prevailed, and Holbrook and Carrier had their minds on growth in the small engine market for agricultural equipment. John Horhne, vice president of the small engine line for Holbrook, the managing partner, remembers the economic atmosphere that year. "The agricultural market at the time was strong and the fact was that at the time we felt our engine technology could be applied successfully to this low-horsepower range," he says. "We felt that our leadership in this technology could develop products better than anything on the market. At the same time, Carrier decided it wanted to get out of the [engine-manufacturing] business and sought us out as a possible partner. We found that together we could probably swing a successful venture." The venture is undeniable successful, having adapted and survived the recession in the agricultural market in the early 1980s.

The partners' styles, says Horhne, are "complementary but different." Holbrook, he says, tends toward modern team-based management theory, whereas Carrier makes use of "the more tried and true management methods." In setting up the partnership, Horhne says, the firms agreed that R&D activities should be conducted by Holbrook at its corporate headquarters. Carrier, however, would share R&D control. A six-member board, comprising three representatives from each partner, would meet quarterly to review Acme's performance and problems.

Engines produced today by Acme are divided into two series and range from 48 to 250 horsepower. Acme manufactures three major components for its own use and for sale: cylinder blocks, cylinder heads, and connecting rods. These then are assembled into engines that are painted, upfitted with other parts, and tested to meet standards and customer specifications. The product, a radically new type of engine, is gaining in the market.

The technology at Acme is undeniably state-of-the art. Robert McLaughlin, who was director of human resources at Acme at the time of its inception until October 1987, recalls that a group from Holbrook and Carrier, employing a private consulting firm, traveled all over the world looking at engines plants. "We wanted the most state-of-the-art, but we didn't want experimental technology. We bought equipment that was in use somewhere in the world, with a proven history." What was unique about Acme's production technology was that it was the first time such equipment had all been assembled in a single factory. The result is a highly automated plant.

In oder to produce its engines in a growing, competitive market, Acme's philosophy calls for "Competitive Effectiveness" -- achieving lower costs via the best use of technology and resources. Competitive Effectiveness is the cornerstone of the company's *modus operandi*. "The whole thrust was we've got to learn to do something different otherwise the competition will eat us up," explains Lynn Schmidt, Acme's new-products coordinator. "Holbrook used themselves as an example and said, 'Look, we know what *not* to do. Likewise, we tended to whip-up on Detroit's automotive industry as the shining example of what not to do....Detroit knew how to build cars, yet somebody was beating them. And it wasn't the technology. The technology in this country is as good as it is in Japan. It was the application of the work force and how you organize that work force."

Rick King, a employee at Acme, explains Acme's Competitive Effectiveness in the following way. There are three areas the firm can improve in order to achieve competitive success: the product, the technology, and the people. At Acme Engine, it is people -- how they are organized, trained, and responsible -- that give Acme its competitive edge. Following Holbrook's lead at its other locations, Acme has adopted an innovative work organization based on autonomous teams of trained technicians. Acme preferred what it called "blank sheet" workers, people who could be trained from scratch, who did not bring along any bad habits from other working environments, and most importantly, who had a willingness to learn and the ability to take responsibility. At Acme, all non-exempt workers, including production and administrative workers are called technicians and all are salaried. Technicians work in teams that in turn work with individuals, called "resources," who are highly skilled technically. The role of resources, in theory, is to provide and transfer both managerial and technical skills to members of the team. Resources were expected to transfer their skills to the point of working themselves out of a job. And

though while skills transfer is still expected, resources will remain an on-going part Acme's work design.

By all accounts, Acme underestimated the amount of time and skill necessary to realize the theory behind the work organization. Holbrook Vice President Horhne says that because he and others expected to teach Acme employees "the ability to think in an industrial setting as well as work with their hands" and "to develop work habits around team methods," employees' lack of experience in factory work may have been a plus. But their lack of training in mechanical skills was "not a plus."

Like everything else it did, Acme's modification of its organization concept was in part a reaction to worldwide competition in small engine manufacture. According to Horhne, the partners originally thought customers would want a standard engine largely for standard trucks and tractors. What customers really wanted, they found, was a wide variety in the components determining engine performance. Customer demand also branched out unexpectedly to various types of engine applications such as generator sets and work and pleasure boats. "By 1986 we were aware that the plant would have to be much more flexible, that some of the systems would have to change to accommodate customers," Horhne says.

Today, almost five years after the first engines rolled down the line, the parent companies marketing strategies and Acme's work organization seem to be working. Horhne says that the Acme engine is dominant in the market for tractors and other farm vehicles as well as construction vehicles. He also says that Acme holds an "increasing share" of the marine/boat market and specialty segments of the truck industry. Further, he reports that losses worldwide for Holbrook in 1986 amounted to between $40 and $50 million, which is an improvement from the previous year. While sizable, Horhne explains that losses of this magnitude were expected as part of Amce's start-up, due in large part to low prices set to keep foreign competition out. These losses are rapidly diminishing with increased volume.

What would Acme's competitors say about the firm? Donald Mahoney, Acme director of supply, responds, "They would say that it's a very strong product in the field. That it's well liked, and that it has some innovative technology...that it's meeting price competition head-on."

Preparing a New Work Force

When it comes to the training process, Acme Engine has its own unique way of preparing workers. There is, for example, the matter of paper airplanes. "What we're trying to do is take a look at work flow," says Robert Landau, manager of performance support and a 21-year veteran of Acme Engine and Holbrook. In an exercise dedicated to illustrating work flow, the paper planes represent the product. A team of 12 employees -- new and existing -- then simulates a production line. The line must quickly move the raw materials from the supplier to the manufacturer -- for upfit, inspection and shipping -- and eventually deliver the product to the customer.

Workers must try out the problems of different jobs by role, playing the parts of supplier, assembler, and customer. Often in the same room, Landau says, another team representing Isuzu or some other firm then devises its own production flow in head-to-head competition. "Our goal is to show in four hours what a day of production looks like," says Landau. "Yes, it is a game but a deadly serious game, and it shows that no matter how many times we design work, things creep into the production flow which retard it."

In part because of its unorthodox training procedures and work organization, and in part because of its intent to train several hundred rural workers with no experience in heavy industry using highly automated process technology, Acme relied heavily on the state's track record of providing quality new industry training. Because of the scope of the project -- a $350 million plus investment in a state-of-the-art facility -- the company received from the state a custom-designed training facility for its exclusive use for five years.

The facility is a 40,000-square-foot branch of Washington Technical Community College. Known as the Oakdale Campus, the training facility was built directly across the road from Acme. During the training period it was outfitted with about $3 million in equipment and staff, according to a senior program consultant for the state department of community colleges. In one sense, the construction of a training facility was inevitable. Shop facilities at the existing Washington Community College fifteen miles away were not applicable to Acme's new machines, and the local labor force had little to no experience in heavy manufacturing. "Even if Holbrook had not suggested this, we would have." says the senior program consultant for the department of community colleges, "The project [was] too large, too diversified. We committed ourselves to equip the building and put

everything in from wastebaskets to the shop." The Oakdale campus is only the second specially built customized training facility in the state.

Project coordinator and state employee Jane Black does remember some friction over the design of the building and type of equipment to be supplied, noting that "Acme did initially request things that were proven later unnecessary. Their original training facility included a request for a mezzanine and balcony, which was fine for dress but not necessary. And in terms of equipment...there was a large shopping list that had to be pared down."

Speaking for the company, Landau says that Acme questioned some state purchases of lower grade, and therefore less expensive, machines, but overall Acme was content. The $475,000 worth of equipment installed eventually included: a hydraulics-pneumatics lab; a precision measurement lab (including a $32,000 optical comparator); a complete audio-visual lab media center (with full video taping facilities to make training tapes describing each Acme job); a machine shop (including vertical and horizontal Bridgeport mills, lathes, grinders, and drill presses); and an electronics lab. No computer numerically controlled equipment was installed during the Acme period, though a $150,000 Matsuura CNC center is now in place for another industry's training program.

Company representatives also seemed pleased with the arrangement. The state hired five training staffers: a machining man from Chrysler, an engine man who had taught at another techncial college; a pneumatics man from a local firm; an electronics man from the Navy; and a curriculum trainer. Acme's own training team consisted of six personnel. Landau recalls how excited he was when he realized that the state would be putting up a training facility. "I felt like I had died and gone to heaven," he remembers. "Here is a dirt field. [The state said] 'design this place and we'll tell you whether or not it meets our criteria.' So several of us really designed the place to look like a factory. It was great."

At the training facility, 486 workers received training from July 26, 1982, when the first four dozen trainees came in, to June 30, 1987, when the state-paid training phase ended and Acme ended its training relationship with the Oakdale campus. The first few groups of trainees received, over 28 weeks, 1,120 hours of training encompassing everything from the company's philosophy of team management, blueprint reading, and economic theory to engine technology and sophisticated machining skills. Over time, the length and scope of the training periods varied to meet differing production and skill related demands.

Enroute, misunderstandings heightened tensions between the company people and the Washington Community College personnel over the method and desired outcomes of the training program. The community college trainers were not familiar with nor very accepting of Acme's work team approach and the training that was necessary to instill work team functionality among the trainees. "Their intention was they were going to do everything brand new and different," Jane Black says. "If they needed a wheel, they would not have used something that looked like it was traditional; they had to invent something new."

Henry Scott, director of industry services at Washington Community College and Black's supervisor on the training, agrees. "They hired some experts out of Monterey, California, paid them a fabulous fee" -- "They called them 'gurus,'" Black intercedes -- "And they hired these people to preach the concept of a team."

Tom Greene, a member of Rolling Hills Industrial Development Commission when Acme came in, similarly has difficulty accepting the appropriateness in the rural South of developing the self-accountability that goes with team organization. "They [Acme] are trying to use a Japanese approach to things, which is a wonderful approach. But the people here don't have the Japanese initiative. And the work ethic, while good, ain't nowhere near what the Japanese do. Our people here are just foremen-oriented."

Recruitment

At the start, Scott says, Acme seemed to work without a plan. "They interviewed 10,000 people to get 49," he says. "Now, they were confused, we were confused, and to this day, I do not know, and I have reason to believe they do not know, what they were looking for. All they wanted to do was make an impact on the community."

Landau and Schmidt counter the coommunity criticism. Landau explains that the first group hired was 45 workers and that the actual number interviewed was 4,500, gleaned from a generic newspaper ad, and those not initially hired were used as a pool for subsequent hiring. The large number of applicants was in part the result of double digit unemployment in the area during the early 1980s. Hiring by groups was done, Landau adds, to stress the team approach. Further, Landau contends, company recruiters knew what they were looking for, even if they were using "perhaps an unusual set of criteria."

Explains Lynn Schmidt, Acme's new-products coordinator who has worked several years in its human resources area, "Through the preliminary surveys of the area, we

knew the traditional kinds of skills that relate to the metal-cutting industry and the engine industry did not exist [in this area]. Therefore, it made no sense to advertise for machinists or electricians in Rolling Hills because the number of them was so miniscule it would be a laugh."

Instead, workers hired had to be the kind who could learn the necessary skills and successfully perform in a work team situation. "In essence what we looked for in those initial hiring efforts," Schmidt says, "were people who could communicate well, written as well as oral. People who could demonstrate in an interview that there were some thinking processes there....There were some real fuzzy things, very subjective things, like 'willingness to learn,'" Schmidt continues. "Not specifically 'Hey, are you an electrician, a machinist, a pipefitter, or whateve?' We did obtained that data from the candidate. But there was no criteria in terms of 'You shall have *X* number of years of formal education.'" The result of the process was that Acme wound up with a relatively highly educated work force. A November 1985 survey (covering the bulk of original hires) showed that 76 percent of technicians had completed high school plus some college.

To Scott, however, there was no consistency in the process. "I have copies of letters from applicants I know; I know a young man who finished top of his class and he was turned down. I know another, a dropout, and they took him....If I sound like I'm bitter, I am. He says that they didn't say they couldn't use him at this time, they told him he was not qualified to work at Acme Engine. Now that young man is now a supervisor at an aerospace firm, one of the brightest young men in the business...."

Schmidt, in response, defends the company's "fuzzy" criteria, saying that the "blank sheet" approach Acme recruiters followed was a conscious decision. "The logic that supports it carries you through what we perceived as truly a team concept," Schmidt explains. "It says that one doesn't own a job in a factory. In other words, I could not hire someone as an electrician and therefore expect him to only hook up wires. There's a thinking that says, if I go out and hire a machinist or an electrician, I probably better be equipped to place that skilled person in that functional activity. And since we knew we were not going to do that, by design the idea was to bring in a number of willing people, call them all some generic thing called a technician -- that did not relate to any functional skill -- and put them all in the same training at the same wage rate." That technician wage rate, which averaged $7.21 in 1984, eventually increased to an average of $9.34 by the end of 1987.

"Our goal, " remembers Bob Landau, manager of Acme's performance support team, "was to help people -- people from a largely agrarian and textile background -- prepare to work on highly automated, very, very technically-state-of-the-art equipment. On a machine that was still being developed. And to operate with something completely foreign to them, which was this team management concept."

From World Economics to Machining: Work Team Development

Acme's 28-week training period was called "Work Team Development," and it was divided into three "modules." Module I was originally three weeks in length, then five weeks, then one. Module I was largely philosophical, comprising orientation to the team and what Acme calls its " seed concept." It also included a day and a half of engine familiarity, a class on competitive effectiveness, and even a 12-hour unit on practical economics -- a direct response, Landau says, to workers who questioned "why we're here." The correct answer, Landau notes, was and is "to make money."

Module II, two months in length, was called general related learning and it concentrated on shop math, blueprint reading, and an introduction to machines that almost all of this rural work force had never seen. About 65 percent of Module II time was spent in the classroom, 35 percent in the plant. By the end of Module II, workers knew their assignments: assembly/testing, machining, or information processing. Module III could then move them into team skill training, where for four months trainees combined classroom (35 percent of time) and OJT training involving actual machining skills (65 percent).

"If I had had my druthers...I would have the jobs well defined, the equipment in place, the product designed, the building there, so I knew what to train," Landau says in retrospect about the training process. Because trainers had to adapt to constant changes in production those first years, the training program kept changing along with the engine. The single style "vanilla" engine construct anticipated at first turned into "38 flavors" as Acme realized that customers wanted many different types of engine specifications.

Reflecting on the Acme training process, Jane Black, project coordinator and a state employee, comments that the modifications of the program were ultimately "a learning experience for everyone." But there were times of difficulty. "Frustration would set in," she says. "Probably the biggest source was they were never able to give us a level at which they wanted these people to perform....We were frustrated because we didn't know

what level they wanted people to perform at when we sent them across the street [to the plant]."

Robert McLaughlin, former Acme human resources director, says that Acme underestimated how long it would take untrained personnel to feel comfortable with precision requirements. New employees were "overwhelmed by the machines," he explains. "It takes a lot of time for people to develop a sense of what's involved with factory life and engine production. It took a lot more time than we thought." McLaughlin further emphasizes the lack of basic math among new hires, recalling. "We had to do 40 hours of pure decimals and fractions." This was a problem that eventually prompted Acme to discard its standard math program in favor of individual diagnostic lessons.

Peter Lewis, an Acme quality technician, meanwhile, criticizes Module III as not having been detailed enough. His on-the-job training was not structured enough, he adds. Both Lewis and Tina Fields, a materials technician, were members of the first group of 45 trained by Acme. Fields appreciates what Acme tried to accomplish, and defends the so-called fuzzy criteria. During her training period, she says "It was like preparing you to become a leader." Fields also says she feels sorry for subsequent trainees who received less extensive team building and leadership development skills than did earlier groups.

To Acme manager Landau, the key challenge facing the training program was figuring how to be flexible in training in the face of constant production changes. "We shifted things around," he says. "The idea was this whole place had to be flexible, and so if we lacked the capability to demonstrate that flexibility in our training program, we were setting a whole mindset that was contrary to the way we were going to operate."

Special campaigns came and went, demanding, for example, training adjustments for upfitting a new engine, Landau recalls. And technical resources installing machines in the plant sometimes changed the whole training profile overnight just by telling trainers about the sequence of machines settled on. Then, three years ago, a production "bubble" occurred, demanding that all assembly/test (A/T) technicians training on the Oakdale campus suddenly transfer to the plant floor to accomodate production. The trainers' response was to implement "custom-fit," separate modules for machining and A/T workers, Landau says. Those same A/T technicians would not return to the training facility for a year and a half. By then, Landau says, sounding grateful, "We knew more about what they needed to do, and what they didn't have to do."

Acme Training Today

Kate Fagan, the curriculum trainer hired by the state for the Oakdale campus, eventually went to work for Acme as a personnel administrative resource person. Enroute, she experienced firsthand some of the training she had once overseen. And, she says, she loved it. One big reason for Fagan's enthusiasm was that her training, though far shorter than the original 1,120-hour, seven-month stint, included a rendezvous with the blue collar world. For a day and a half, Fagan recalls, she underwent engine familiarity; then, once she was on the job full-time, she was called away from her desk during production crunches to help out on the factory floor. The point, she says appreciatively, was "to have more of a buy-in and ownership of our product."

Today, all that has changed, as the start-up phase is ending and Acme is no longer hiring people in large groups. Now, many of the newly hired employees must have a minimum five years expertise in their area, preferably gleaned in a metal-working environment or with one of Acme's parent companies. And employees now go through an orientation and on-the-job training that are far shorter and more focused than in the past. The whole training period has been shortened to 48 hours spread over six successive Wednesdays. The experienced production worker can be fully assimilated into Acme within four months, Fagan says. But the introduction to the engine available to administrative workers has been whittled to four hours. "I think we're suffering for that," Fagan says. "Our philosophy and ideas early on were not to have clerical and office people separate from production....A lot of emphasis was on not putting people off in an ivory tower, keeping them separate."

"Now we're doing what's being called productivity improvement training -- structured, on-the-job training," Landau says. Skilled operators train new operators as they begin rotating among the pieces of equipment. And a training manual for every work station on the shop floor is being designed. "Job performance aids," visually describing what needs to be done at each work station, are being developed. Certification procedures are being established detailing to what standards tasks must be performed. When a technician returns to a job after an extended period of time, he or she must be recertified for that job.

With hindsight, Landau identifies some of the reasons why adjustments were made to the training program during the start-up years. First, the training program began well before the plant was even built, so routine adjustments to production meant corresponding

adjustments to training. Originally, the trainers believed the plant would be producing a "vanilla" engine, which would require less technical flexibility from workers. Similarly, the trainers were unable to provide structured on-the-job training from the beginning. The up-front OJT that was done was often not put into practice for three years -- thus prompting the need for retraining. Now Landau and others are designing a skills training program to develop a depth of maintenance and repair skills among workers. "It's not an apprenticeship program," says Landau, "but it's so close you wouldn't know the difference."

Landau explains that in trying to develop breadth of skill among all workers, the training program underestimated the time it would take to develop the accompanying depth of skill necessary for success. Acme's Schmidt concurs with Landau. Today, Schmidt says, without the depth of skill necessary to maximize capabilities on the machinery in the face of increasing volumes of engine orders, "we're still struggling...because we do not yet have that depth of skill in a lot of areas." Schmidt continues, "I think one of the things that has created our [obstacles to] developing that depth of skill is that you really have difficulty teaching somebody the kind of technology that they have to learn in our industry, not just our company, if they can't basically read and comprehend written or verbal instructions.

"If they cannot convert whole numbers to fractions, if they cannot add negative numbers, I mean it's just really so basic, and I think that was one of our biggest surprises. We had beautiful training programs and beautiful trainers, and when we found it wasn't taking....We were finding that we had to back up and teach remedial math, remedial English. And I think that's still hurting us."

Inside the Plant

Walking inside Acme Engine Company's 1.1 million square foot, multi-million dollar plant, one is immediately struck by color and light. Red, blue, purple, green, and yellow piping and ducts work their way across the walls and ceilings. Sunlight streams through the many skylights that are strategically positioned to maximize light at areas with the greatest concentration of people. As the company brochure states, "The building was designed to reinforce many of the operational concepts that are so important to the functioning capability of the plant." These operational concepts emphasize a team approach to the firm, where all contributors share in making the company successful. To reinforce

the idea, all employees walk through the same door in the morning, all eat in the same cafeteria, and no one receives special parking privileges.

There are currently about 700 employees at Acme, and of these, over 500 are technicians. Of the total work force, about 35 percent are women and 47 percent minority. Almost two-thirds of the technician work force are minorities while 19 percent of the exempt employees (resources and the Company Operating Team) are minorities. Women, on the other hand, make up only 11 percent of the exempt work force. Joseph Conroy, the current director of human resources at Acme says, "The company has done a good job of creating a climate where EEO and affirmative action are considered a normal part of operating the business." Conroy adds, however, that although minorities are well represented on the Company Operating Team, Acme has had trouble recruiting minorities and wormen in traditional professional fields such as engineering.

The operational concepts of the Amce plant include a whole new organizational vocabulary that parallels new functional relationships. In addition to "resources" and "technicians," titles that help redefine personnel roles, the organization of the plant itself is defined in new terms. The plant is divided into three main areas -- machining, assembly and test, and support functions. Each of these areas, in turn, is divided into businesses and each business into a set of teams. Machining, where components are fabricated, is physically separated from the assembly/test (A/T) by a central core which houses administration, quality control and other support functions.

Machining

The machining unit is composed of three businesses, which manufacture cylinder blocks, cylinder heads, and connecting rods, the only three parts fabricated at the plant. For each business there are two different production lines, one for each of the two series of engines produced at the plant. On the 1,500-foot, S-shaped Series 2 block line, the block travels, automatically, through a transfer line of 18 machines, each with a series of work stations. The first machine, which drills bolt holes into the block, is made up of 21 work stations. The Series 2 block line operates under a distributive control system, i.e., a main controller at the beginning of the line "communicates" with the smaller, individual controllers at each work station. The result is that only the main controller needs to be programmed, instead of the many individual stations. The newer of the two block lines, it was put into place in late 1984.

The Series 1 block line is a high-volume line built in 1983. It operates on a discrete control system without a main controller but with individual controllers for each machine. According to Matt Levy, a manufacturing engineer with Acme since 1982, the control systems on the two lines represent how quickly so-called state-of-the-art equipment becomes outdated. From a quality perspective, the Series 2 block line has been the most problematic because, as Bill Cunningham, manager of Product and Customer Quality explains, it is the most complex and therefore has the greatest chance for error. Cunningham notes that the block line has between 3,000 and 4,000 requirements, whereas the rod line has maybe 100. In addition, market changes have led to block machining tolerances for which the original equipment was not designed.

The lines for the Series 1 and 2 cylinder heads and connecting rods are similar to the block arrangement. The Series 1 lines are older, and they are discretely controlled, while the newer Series 2 lines are distributively controlled. At a Cincinnati Milacron machine, a person hand loads cylinders heads into the machine, which is enclosed with windows for viewing the actual machining. Inside, one cylinder head is ground while another, already machined, is being unloaded. According to Levy, "This is a classic case of automation. A person hand loads, and that's all they do. You'll see a parts loader. One part is being machined as another is being loaded or unloaded. What you have is two simultaneous activities."

As a machined cylinder head is unloaded from the Cincinnati Milacron, a technician is conducting a statistical random sample of the cuts made by the machine. The technician uses automatic gauging equipment to test the cylinder head, and must read and interpret the cross-bar chart that appears on the display terminal. But in other parts of the machining operation, the gauging and adjustments are done automatically through feedback loops.

Further along on the Series 2 cylinder head line, a gauging machine awaits an operator for periodic check. Levy demonstrates how a technician operates this machine. The operator inserts a gauge into the machine, a blue light flashes to indicate that a measure has been taken, the measure is automatically recorded in an adjacent computer, and the operator's work is done. According to Levy, the operator does not need to know how to read or interpret the measure, he or she only has to know how to insert the gauge.

All of the machining equipment is American made -- Cross, Sperry-Vickers, Cincinnati Milacron, Lamb -- with the exception of the Series 1 connecting rod line. There the equipment is made by Alfing, a German company, that specializes in machine systems

for connecting rods. The newest line, the Series 2 connecting rod line, has been in the process of installation for the past two years and is not yet complete. Most of the equipment is made by Bendix, and it includes five robots and automatic gauging stations throughout the line.

According to Levy, the more automated the machines, the fewer people necessary to operate and supervise those machines, and the greater their skills have to be. "There's kind of a rule here," he continues. "The fewer the people, the more their capability. As you go to more automation, the greater the technical ability" that is required. There is no question that both machining and assembly/test operations are highly automated. Bill Cunningham, quality control manager, estimates that 90 percent of the plant is automated. The machining lines are the most automated and the least labor intensive. In fact, relatively few people work the machining lines, especially the newer ones.

In one sense, considering the great number of work stations on each line, it is surprising how few people are needed to operate the lines. Yet almost all the individual tasks are performed automatically, and the lines are equipped with in-process gauging and computerized machine maintenance monitors. Because of the high degree of automation, the work of the technicians falls into two very different types of tasks. When the lines operate smoothly, technicians perform simple operations, monitoring the monitors and checking inventories. When there are problems on the lines, however, teams need to have the skills to work together, identify the problems, and come up with solutions. Hence, the need for greater skills.

Assembly/Test Unit

Components from machining are transferred across the plant to the assembly area by a state-of-the-art electric overhead monorail material handling system, minimizing the need for forklifts. According to company literature, once the castings are loaded onto the block and cylinder head lines, they are not physically handled again until they are loaded onto a shipping skid as part of a finished engine.

In Assembly/Test (A/T), there is only one business, but it encompasses two assembly lines, testing, painting, upfit, and shipping. This area, although highly automated in terms of material handling and inventory, is much more labor intensive than the machining lines. According to Rick King, a resource transferred from Holbrook to Acme in 1986, the assembly procedures that require the greatest precision are the ones that

are automated, because automation permits more exact production with closer tolerances. The remaining procedures are broken down into tasks that require less precision, which technicians perform.

On the assembly lines, a waist-high conveyor system moves the engine through a series of manual and automatic work stations. At each station, there is a display monitor, part of the Assembly Information Management System (AIMS), that displays a "bill of materials" to the assembly operator. The display tells the operator the serial number of the engine coming through and the part, including its serial number, that needs to be put on the engine. Not only does this system track inventory and production as it relates to customers' orders, it also helps to ensure that the assemblers are putting the right piece in the right place on the right engine.

Once assembled, the engines are automatically transferred to the testing area where every engine is "hot" tested in one of eight fully automated, self-diagnostic test cells. A six-minute performance test is conducted on each engine and sophisticated diagnostics determine the probable cause and suggested repair for any performance malfunction. Once tested, the engines move on to the fully automated painting area.

The newest process in A/T is the upfit area, which was established in the spring of 1987 though its layout and functioning are still being developed. According to manufacturing engineer Levy, upfit has evolved as an outgrowth of marketing. As Acme customers began to require a greater variety of engines, an upfit team slowly evolved. Upfit basically allows Acme to offer its customers a custom-made engine.

The Central Core

The central core of the building houses the Company Operating Team (COT) administration, quality control, the cafeteria, and other support functions. The COT includes top management, and in accordance with company philosophy, their offices on the second floor of the central core are not the comfortable and swanky work places of many top managers. The administration floor is one large room, compartmentalized into office spaces by modular dividers. The offices are neither private nor large, and compared to the rest of the plant, which is full of light and color, the administration offices are relatively dark.

Quality Control, located on the first floor below administration, is made up of 55 people and seven teams. The Quality Control laboratory also uses state-of-the-art testing

and gauging equipment that includes a fully equipped metallurgy lab. Bill Cunningham, the Quality Control manager who has worked in the automotive and aircraft industries, prefers Acme because of what he calls quality and damage factors. "Automation is the single greatest factor that allows you to move into levels of quality to compete worldwide," says Cunningham.

Cunningham explains that in a non-automated environment, people are responsible for keeping parts moving sequentially, where human error is high. Automation controls that, as well as allowing for safer handling of materials. Cunningham sees no point in automating any more of Acme's processes because the defects that do occur would not be improved by further automation. "The majority of our problems are somehow component mix-related, meaning if we built the same engine every day, our defects would be in the million rate [i.e., defects per million] instead of the 10,000 rate," explains Cunningham.

Quality Control uses a modified, self-designed version of statistical process control that it generically calls preventive statistical control techniques. Automation requires preventive controls because the personnel does not exist and production is done at such high speed that it would be impossible to test all pieces as they are being produced. Cunningham says that less than one-tenth of one percent of the parts are actually tested, and in the last three years, quality costs have been reduced by half.

The Organization of Work--From Theory to Practice

Undergirding the above description of the production layout is what Acme calls its "Seed Concept." Most of the Seed Concept deals with traditional manufacturing goals -- to produce the best product at the highest quality for the lowest cost. What is unique about the concept is the *manner* in which the company achieves those goals; that is, goals are achieved

> **in a way** that promotes a higher quality of thinking, the continuous development, acquisition and sharing of skill and knowledge, recognition of personal rights and responsibilities to contribute to decisions, and the assessment of results by measuring everyone's human and technical contributions to improving competitive effectiveness....

In 1979 and 1980, a core group of Holbrook personnel (two of whom are still at Acme) came to Oakdale to oversee the construction of the new plant and to brainstorm about the seed concept and organizational principles that would guide the development of

Acme. "The thrust of Holbrook top management was 'You will do something different,'" says Lynn Schmidt, who came to Washington County in 1981.

"The president of Holbrook said 'I want you to take from [other Holbrook plants using team organizations] the lessons to be learned. We want you to implement something that is light years beyond where they are after 7 or 12 years.'" adds Landau. "And it was a foregone conclusion, I would say, that this was going to be team management, team involvement. That was clearly the way this company said we were going to operate. The whole thing was around competitive effectiveness."

Holbrook was looking for a way to ensure its competitive niche. The technology existed, so that wasn't it. The product already was good and widely accepted. The edge would come, as King pointed out, through people, through technicians who have a stake in the company, who understand competition and quality, and who are responsible for whether or not the company succeeds. The central premise of Acme's organizational theory is that technicians, working in teams, are the focal point of all production. Teams were to be self-supporting and self-directing, working, according to McLaughlin, 60 percent of their time on production work and 30 percent on staff work -- inventory and purchasing, maintenance and repair, and quality control.

As stated earlier, Acme hoped to develop in workers a breadth of skills, not only through the extensive training program but also on the job. According to the theory, technicians were to rotate throughout the plant, learning various jobs both in machining and assembly. This breadth of skill would extend to clerical and support staff as well. Everyone at the plant was to know how to make engines.

In addition to bringing technical and managerial expertise to the teams, resource personnel were actually to "transfer" their skills to the members of the teams and eventually make themselves obsolete. Organizationally, resources were to be at the same level as teams. Teams were to be self-accountable. Members of the team were expected to establish their own work schedules, their own functional designs. In addition, teams would determine and set-up their own Assessment Process whereby team members would evaluate their peers, review each member's completion of a skills module, determine whether or not to grant a raise on the basis of that completion, and fire a member if the situation warranted.

When asked about the relationship between new technologies and new organizational methods, Matt Levy, an Acme manufacturing engineer with many years of manufacturing experience behind him, says that a firm needs to develop a compatibility between people and method. There is something about highly automated production that lends itself to, in fact requires, a new way of organizing work. Levy says it is the difference between "using a machine and controlling a machine."

For Rick King, an Acme resource, the organization of work is "the most fascinating part about the whole automation process" at Acme Engine. "In theory, the team concept is really good. Management says *what* to do, like perform to a 3 percent scrap rate, and the teams have to figure out *how* to do it." The technicians interviewed, who have been at Acme since the beginning, agree.

"The main thing I like about being here is I feel like people trust me to do my job," says Tina Fields, presently a materials technician, "No one is hanging over my head. No supervisors. [The understanding is] 'We know you are going to do your job.'" Peter Lewis, a quality technician, also agrees.

With that autonomy comes responsibility, and although that has sometimes led to stress for Fields, it has more often led to pride, respect, and satisfaction. Her past experience includes working as a surgical assistant at the local hospital and as a line supervisor at a nearby manufacturing firm. She took the latter job after quitting Acme because of the stress from job autonomy and responsibility. But she hated the supervisory role, looking over someone's shoulder and knowing that someone was looking over hers, and she says, she came "running back" to Acme.

In the early days of production, Fields recalls that workers had time to learn from resources and to develop their skills in various areas of production. "Every time they brought in a new machine it was like Santa Claus. I had never touched a machine. They'd say play with it and see what it does." But taking the time to familiarize and feel comfortable with new equipment was a short-lived luxury as production began to speed up and cost and quality pressures became a reality.

At Acme, going from organizational theory to practice has been an evolutionary experience. What the company set out to achieve in terms of building capacity among technicians and teams during the initial five years has been re-evaluated. The company realized that its expectations were too great and that the skills development it desired is

better acheived over a lifetime rather than over a five year period. Acme remains devoted to the team concept, and the plant is still run by a sytems of teams, yet the process by which teams are developing capacity has been modified to reflect a longer time frame for team and skill devleopment. As a result, team functioning has also been modified.

There are a variety of factors contributing to the changes in teams functioning. Most important, by 1986 Acme was not meeting the productivity rate -- engines per person per day -- that its two parents desired and its customers demanded. This led to time pressures that constrained the ability of resources to transfer their skills to technicians and of technicians to learn new skills and experiment with new machines. "The volumes were going up," says Schmidt, "but our capacity or capability to react in a timely fashion just did not exist. In fact, I think we are still struggling with that today."

Peter Lewis, quality technician with Acme since the beginning, remembers his disillusionment with automation. "Frankly, I expected more out of it. I thought it would be more reliable and fine-tuned. This plant has been referred to as having state-of-the-art equipment, but we started producing all these products, and you ask, 'Where is the expertise?' and someone says, 'I don't know. I never worked on this before.'"

And the plant is in a transition period -- there are not quite enough orders to merit two shifts, yet there are frequently more than 300 engines produced per day, leading to significant overtime according to Cunningham. He adds that the overtime has led to morale and personnel problems. Technicians Tina Fields and Peter Lewis agree, and although they talk with commitment about pushing during the production crunch, they very much look forward to the return of their eight hour day. That commitment, a measure of success of Acme's training program, particularly Module I, is evidenced in the language such as "ROI" (return on investment) used freely by Fields and Lewis when talking about their work.

Another factor influencing organizational changes was that instead of producing a single engine type -- the vanilla engine as it is referred to at the plant -- Acme began to modify its product deliberately to suit customers' needs. With a single product, it may have been possible for technicians to develop a breadth of skills for successful production because in that situation, the automated process technologies would operate as if they were dedicated machines. But producing a variety of engines requires flexible production -- using the automated machinery in a variety of capacities. "We did not have the depth of

skill that would allow us to maximize the capability of the equipment and machinery that were there," say Schmidt in reference to flexible production.

And finally, as was iterated by McLaughlin, and reiterated by his replacement Joseph Conroy, Landau, Schmidt, and others, the company underestimated how much time it would take for technicians to learn the extensive skills that the company, perhaps unrealistically, had initially envisioned. In the training process, Bob Landau and others realized that the initial intent to develop a breadth of skills among technicians came at the expense of depth of skills. Similarly, on the production line, rotating through various tasks took away from developing advanced skills on a given job. As Fields says, "It would have been great if everybody could have functioned in every capacity. However, every time you learned something new, you lost skills" by not continuing to practice in the area just previously learned.

Various tasks assigned to teams began to fall through the cracks, most notably maintenance and repair, quality control, and inventory. In 1985, Acme began what it calls its "Renewal Process" to address the production problems that were growing apparent and increasingly costly. The process began with a change in leadership. The plant manager at Acme since the beginning was replaced by John Horhne, from Holbrook. Horhne identified ten areas -- including delivery, cost, inventory, safety, and quality -- for improvement. Curt Davies, a Holbrook veteran from the Charleston plant, was transferred to Oakdale to oversee improvements in the manufacturing support area. Together, the Company Operating Team (COT) sought to identify and implement strategies for improving operations while at the same time remaining true the the concepts of a team-based approach, self-management and mutual respect, minimal hierarchy, and development of breadth of skills among all employees. Acme has remained true to its organizational philosophgy while at the same time recognizing that it five to seven year time frame was unrealistic. According to Hornhe, Acme did not overestimate the potential of the work force but rather it underestimated the hard skills associated with machining and how long it takes -- *on the job* -- to acquire those skills.

Just as the emphasis in training went from developing breadth of skill to developing depth of skill, the emphasis of the Renewal Process has been a shifting away from developing organizational *form* to developing organizational *function.* Although Davies does not like the word centralization, it best describes what the Renewal Process has done with those plant functions that required greater depth of skill.

Davies says, for example, that when he arrived, Acme spent too much on regrinding tools -- "We did not have the skills to keep the equipment running." To remedy the situation, maintenance and repair is now a separate function, housed in machining, and Acme has had to recruit trained machining repair people from the Midwest. Acme is trying to establish the right mix of breadth and depth people to facilitate the overall skill development of the work force. Now, according to personnel resource Kate Fagan, newly hired resources have a minimum of five years of experience in their area, preferably at a metalworking firm or at either a Holbrook or Carrier plant.

Maintenance skills were simply not being transferred from resources to Acme technicians. According to Rick King, resources, "incredibly skilled people," were spending their time fixing machines instead of transferring their knowledge of how to fix machines. "The bottom line on the block line," he adds, has been that simply more people are needed. But in order to keep the person-per-engine ratio down, Acme has not added more people and there has not been enough time for skills sharing. King points out, however, that that is changing and more skilled technicians will soon be added to the line.

Another area that the COT sought to address was inventory and purchasing. Each business was ordering its own parts, and when Davies arrived, "There was 45 days worth of inventory in the plant, but not the right parts." Technician Tina Fields recalls that when she started, she was the member responsible for materials in her team. And although she has worked in various capacities throughout the plant over the course of the last five years, materials is the area in which she prefers to work. Now she is a materials technician for inventory and purchasing, which has also become a centralized function.

Various adjustments have been made to team functioning as well. No longer are technicians rotating throughout the plant learning various tasks; instead technicians are in relatively permanent assignments to teams, in theory developing depth of skill in the work of that team. As Peter Lewis puts it, "Too much moving around is just too impractical." But Kate Fagan, a personnel administrative resource, recalls how two years ago, when Acme had trouble meeting delivery deadlines, she and other administrative staff worked two to three weeks on the production lines. Now, with what Fagan calls a change in attitude and the hiring of more skilled workers, Acme has stopped that practice. She adds, "I think we're suffering for that."

In order to provide rotation and skill broadening on a more regulated basis and with a career focus, a job posting process has been established. The process involves both the

"sending" and "receiving" teams, as well as the team managers. Another area of team functioning that has been streamlined is the Assessment Process. McLaughlin says that business demands require more time on production, and that Acme "can't afford so much time for the Assessment Process." It used to take 10 to 12 people about 10 to 12 hours to review, for example, a members' completion of a skill module and the merits of a raise. In addition, reviews and wages were based strictly on skill (measured by completion of a module) without any relationship to performance. Now, two or three people perform the assessment, taking into account peformance qualifiers -- on cost, quality, delivery, inventory, and safety -- that have been set by the teams themselves in what is called Work Planning and Performance Review.

Another major organizational change is the introduction of middle-level management, the team manager. The new, first line supervisory position has come into being at a time when the number of resources is being reduced, according to Acme's original schedule. In late 1986 and early 1987, 13 resources were transferred or layed-off. "We've now inserted a level or a function [the team manager] that we initially pooh-poohed as something we did not need if we hired and trained the right kind of people," says Schmidt.

The title of team manager is misleading, as one team manager works with a number of teams in a given business. Sudie Peterson, team manager for paint and upfit teams, describes her job as managing information flows through the teams. Team managers bring to the team management and business skills rather than simply technical skills. The team managers provide leadership and are responsible for decision making, while at the same time they are trying to maintain themselves as part of the team. Schmidt tries to explain this precarious position as follows. "The team manager, as we've inserted him, is not your foreman or your supervisor, he -- and this is a very tight line, a very delicate line to walk -- he cannot allow himself to become their decision maker. That is so anti [to the team concept]....And the team manager's principle role in my mind is still consistent with what we said a resource was in the beginning -- to help that team develop the ability to manage itself."

Could resources really work themselves out of a job, or is that simply a utopian ideal? "I would respond to that by saying yes and no," answers Schmidt. "The real thrust of the idea is one of transferring skills to the traditionally hourly work force that traditionally aren't transferred to hourly workers....If you take that to utopia, if you will, the resource transfers those skills such that he or she continues to get further and further

away from the work and eventually disappears riding off into the sunset because now you have a traditionally hourly work force who have absorbed that skill. Now the reality of that is -- and this is why I say yes and no to that -- I think it's absurd to think that we are going to make a first class electrician out of everyone in the plant, or a tooling engineer, or a manufacturing engineer, or a training manager....There are some functional skills in terms of resources that will never go away."

What appears to be happening is that Acme is reshuffling skills. Some of the technical skills that the resources were to be transferring to production teams are now being taken away from the team and centralized in maintenance and repair, quality control, and inventory and purchasing teams. And some of the managerial tasks that resources brought to teams are now being performed by team managers. The immediate result of this reshuffling is a loss for teams of the responsibility and authority they once had, though the long term objective is to reinstate those functions back to the teams. In keeping with the principle of Renewal, the purpose of the reshuffling is to make more efficient use of scarce technical resources and to "coach" teams through team managers on how to learn and apply skills. In the interim, the teams are building the capacity to take on increasing responsibility, and team managers are there to show them how.

There are immediate problems with this reorganization, according to McLaughlin. "People feel more constrained. They feel as if something has been taken way from them, and it has. They have less responsibility." And the situation is aggravated, he says, by an "erosion of trust" among technicians that has occurred with Acme's recent management turnover, which has accompanied the change over from a start-up to an operational plant.

Tina Fields agrees that there has been a loss of decision-making power and a loss of responsibility for technicians over the years. And among workers, she says, there is a sense of insecurity about the future of the organizational structure. "There are lots of rumors each time the plant manager changes," she says. But she does not believe that Acme could ever adopt completely traditional management techniques because the present work force would not accept it and because Holbrook just wouldn't do that. Fields is sorry about many of the changes that have taken place, but she is quick to point out that Acme still offers the best working environment in the area.

Along with the Renewal Process, Acme is making the transition from a start-up to an operational plant. And it is hard to separate out the changes that have taken place and are taking place in the organizational structure at Acme. Although some are in fact due to the

successes and failures of implementing Acme's seed concept, some are also simply part of the natural progression of a new start-up.

Rick King came to Acme from Holbrook in 1986 to work with a new piece of material handling equipment in machining. He now serves as financial controller of all the machining lines. He explains the changes taking place as being part of the typical life cycle of a Holbrook plant. King calls the first stage the "left stage," where there is a "concept plant" with non-traditional work design and much autonomy among workers.

The second stage is the "panic stage," where everyone starts to realize that the company isn't meeting its production schedules or quality control standards. At this point Acme initiated its Renewal Process. And the third stage King calls the "right stage," where the company moves toward more traditional management with clear lines of authority and better reporting and accountability mechanisms -- the outcomes of the renewal process. At Acme, this stage also includes clarifications in language. As Matt Levy explains, it is very confusing for people from the outside to know who does what at Acme based on title. So now, Acme is using terms like manufacturing engineer, quality technician, and maintenance technician.

Robert McLaughlin served as director of Human Resources for Acme from the beginning until he left in October 1987. He says that the organization and the company are as solid as they have ever been, and that the product is good and selling. "I feel relatively OK about leaving. I couldn't leave if I felt I was needed or if my work was incomplete."

Lynn Schmidt likens the Acme experience to "the kid outside the bakery store window -- eyes were too big for his stomach. It was a great idea at the time, I think we may still get there. [But it was] too much too soon. We couldn't handle it."

Outside the Plant: Community Relations

Christmas Revisited

When Acme Engine came to Washington County in 1980, it is not clear how well they understood the political and social environment in which they were locating their state-of-the-art facility. David Nickerson, then executive director of the Holbrook Foundation,

the corporate philanthropic body, says that Acme (and Holbrook and Carrier) officials were "naive....We did not realize that the issues [of schools and race] were that polarized or that deep-seated," Nor did they realize the extent to which those issues would interfere with Acme's ability to do business as usual.

Susan Perkins, executive director of the local Legal Services office, which represented the communities of Appleton and Howard Heights, agrees that Acme did not fully understand the community. "I think what happened is that Acme got a snow-job from the pro-development people who portrayed everything as rosy, everything was great, and everyone was together...And I'm almost certain they [Acme] did not understand the complexity of the community in terms of racial divisions and class divisions. That was not even alluded to in the recruitment process."

The Holbrook Foundation, which works with the communities in which Holbrook plants locate, historically has been concerned with funding projects that support civil rights, the quality of local schools, and community-based organizations. Unlike other Holbrook locations, where the foundation becomes involved gradually in the communities, in Washington County the foundation became actively involved early on in a variety of community issues surrounding Acme's location. That work continues to this day.

Much of the discussion that follows deals with the community impact of Acme's location decision and not of its automation *per se*, yet the authors believe the excitement surrounding Acme's location was exagerated because the proposed plant was so highly automated and represented something so completely new. The overwelming state and local support for Acme's recruitment would not have existed if the branch plant locating was a traditional mature industry operating without a technologically advanced production process. In that excitement, the community became divided on a number of issues, as the effort-at-all-costs to attract Acme heightened tensions between the City of Rolling Hills and Washington County, between the communities of Howard Heights and Appleton and the local and state governments, between the local business community and Acme, and between Howard Heights and Acme.

As mentioned earlier, Acme required land, a training facility, water and sewer extensions, and a widening of the two-lane highway in order to locate in Washington County. The county asked the town of Oakdale to apply for a $5.9 million Urban Development Action Grant (UDAG) in order to cover the various public costs associated with the industrial recruitment. The UDAG request included $1 million for the purchase of

the Oakdale Mayor's 47 acres adjacent to the plant needed for Acme's expansion, $2.3 million for water and sewer extensions, $750,000 for the training facility, and $1.8 million for improvements for the town of Oakdale and the Appleton community. It did not include funds to relocate the 12 Howard Heights homes that would have to be moved due to the widening of the highway and the construction of the training facility.

The UDAG was ultimately denied because it could not possibly meet HUD's "but for" requirement -- namely, but for the grant, the prospective firm would not locate in the community. Acme's commitment to the project was solid; it already owned the land and in December 1980 it announced it would locate in Washington County provided it received the services it was asking for. Unable to wait for the UDAG processing, local and state leaders in the interim pledged their commitment of funds to meet Acme's demands in order to ensure their standing in the competion for Acme.

Local business leaders came together in an extraordinary example of local private commitment to raise the $1 million for the Mayor's land. The effort was incorporated as a not-for-profit development corporation, and 92 local business people personally signed $15,000 notes guaranteeing a loan from five local banks. The loan was secured by individual signatories, nervously hopeful that their subsequent funding drive to pay back the loan would be successful, which it was.

Previously, however, undeveloped land in the area sold for between $1,000 and $2,000 per acre, *much* less than what the Mayor was asking As a result, the mayor made himself almost immediately unpopular. An anonymous banker at the time was quoted as saying "'I guess the mayor better move out of town' if the money can't be raised and the plant goes elsewhere." Washington County Commissioner Robert Stills recalls, "It was awfully hard dealing with him and I don't know whether he really wanted to sell it or whether he just wanted to see how much he could get for it." Whatever the case, officials unsuccessfully leaned on the mayor as much as they could, even getting the Governor to phone him at one point.

In addition to land, Acme was demanding infrastructure, and here the state government could get involved, promising funds for a $726,000-elevated storage tank, a widening of the two-lane road, and a training facility. In addition, Acme required water and sewer service. The water and sewer line to be built from the City of Rolling Hills to the plant cost $3.23 million, and the question was who would pay for what? The Washington County commissioners asked the Rolling Hills City Council to pay 50 percent

of construction costs, as it usually did when lines were extended into the county. But for the first time, city leaders hesitated. As the Rolling Hills Mayor explains, because Acme was so far from Rolling Hills, it was unlikely the city could annex the land; in fact, the Town of Oakdale would have first chance at annexation.

But a Washington County official who wishes to remain anonymous, claims that the city wanted to use its cooperation on the water and sewer extensions as a leverage on the school disputes. The source claims that "for the first time, there was some hesitancy, and even some maneuvering, by the city council with the county to do something about the school problem." The Rolling Hills Mayor flatly rejects this contention. "That was mentioned as a possibility," he acknowledges, "but if that's what we intended to do, we would never have allowed them to tie-in." In the end, the county paid for the water and sewer line and the city provided the water. Since then, the lines have been donated back to the city and according to the county source, "the city owns everything -- all the lines and all the revenues."

In the intervening rush to find money for the land and the vital water and sewer connection, the two rural communities abutting the Acme site, Appleton and Howard Heights, were overlooked and beginning to make their concerns about water and sewer and relocation assistance known. For these two unincorporated communities, water and sewer improvements were a long-standing issue, and previous attempts by the community for block grants received little help from county officials. In the case of the UDAG, advocates contend that the communities were used as "pockets of poverty" to improve the application's chances of success when, in fact, the proposed water and sewer improvements in the UDAG would actually bypass Appleton and serve only Acme and the mostly white town of Oakdale.

Further, officials had quietly rezoned Howard Heights to incorporate its homes into the community of Appleton to satisfy UDAG requirements, though neither community knew of the rezoning at the time. Bob Crane, a Legal Services aide working directly with the communities recalls that McBride, the county director of planning at the time, carried out the rezoning without the legally required public hearing, and he was forced to resign weeks later. In addition, the communities were not properly notified of the federally required public hearings for community input into UDAG proposals.

McBride himself says that the contention Appleton was used to get Acme "is not entirely accurate." In fact, he says, the entire town of Oakdale was classified as a

distressed community for UDAG purposes, and Appleton wasn't "used"; rather that is simply the way grants operate. Further, McBride says that a Community Development Block Grant application he submitted for Appleton back in 1979 probably failed because a CDBG had already been granted for a nearby community west of Rolling Hills and not because of lack of support by the county.

On the issue of Howard Heights' relocation, Don Mahoney, director of supply at Acme, is blunt. "Simplistically put, the houses would have been bulldozed if it hadn't been for Acme," he says. According to Commissioner Stills, Acme made known to local leaders its concern that the families of Howard Heights be justly relocated and compensated for their hardship. Acme officials not only seemed to be concerned over the fate of the 12 families, they donated $45,000 to the local business development authority to help fund the relocation effort. The authority, in its private, not-for-profit capacity, was used by the county to negotiate the relocation settlement. In addition Acme consultants drew up a cost estimate for the relocation totaling $364,600 and including payment for land ($62,000), the moving of homes ($9,000 each), aggravation money, motel bills, and other needs.

Mahoney continues, saying that Acme was "the catalyst that kept the whole thing together and, I think, significantly improved the quality of life of those 12 families. There undoubtedly was a joint effort but there was a lot of maneuvering that had to take place in the inter-politicking of city, county and state governments. I would say our role in it was the consciousness that these were 12 families that needed to have the quality of life and that just razing the homes and giving them *X* amount of money wasn't the answer. That widening the road and cutting their front yards in half wasn't going to help protect or improve their quality of life either."

Acme, as a private enterprise, worked behind the scenes, and some local residents did not share a sense that Acme was working on their behalf. The result, according to Susan Perkins, Legal Services executive director, was that residents of Howard Heights felt "a sense of hostility" toward Acme, in part becasue Acme was so visible, building its plant across the street. In addition, the residents confronted the company for answers on how they would be compensated, when in fact the only legitimate answers could come from government officials. Acme undeniably had influence in determining the fate of the twelve families, and the community was looking for an explicit public position from Acme of support for Howard Heights.

Perkins recalls the tense atmosphere. "At that time most of the communities had not been affected by the Voting Rights Act, which is to say most of them had predominantly white boards...county commissioners, city councils, development councils. So the concerns of Howard Heights and Appleton were peripheral to the whole package being put together. I think initially there was some amount of money written in for relocating these people, but of course it wasn't done with any consultation from them and whether or not it was going to be sufficient -- and whether or not they wanted to move at all hadn't really been addressed. It was more or less taken for granted they would.

"The total atmosphere was intimidating because everything was on a fast track. They had a certain amount of time to raise this money, and everybody was 'gung ho, push, push, we've got to do this and do that.' So [advocacy on behalf of the communities] was seen as anti-development. Blacks were not optimistic that anything could be done, and even some blacks felt, 'Well, that just has to be sacrificed.' And most didn't know what the officials were talking about. I'm trying to create for you a picture of this pre-Voting Rights atmosphere" Perkins continues, "where low income [people] and blacks had never seen the system have to respond to them. So you had an atmosphere that 'if these folks say this is the way it is, you're not going to stop it. Why stir up trouble?'"

Instead, Legal Services embarked on an education program to counter the intimidation residents felt in their dealings with local and state officials. Legal Services held workshops to teach the community residents about eminent domain, zoning, and UDAG language. Crane recalls how "people from DOT [Department of Transportation] would come down and speak in a foreign language to these people and really scare them." The people felt like they were being "ram-rodded," he says.

Other people view the Howard Heights situation differently. "You know, they also got people behind this who wanted to see just how much they could get," says Commissioner Stills. "The people that owned the houses had sound legal counsel, and legal counsel of course was trying to see what [the local leaders] would do and how far they would go." Tom Greene agrees, saying that the legal counsel for Howard Heights "was just asking for the moon and the moon wasn't necessary."

Eventually the residents of the two black communities slowly gained political power as local government began, for the first time, to respond the their concerns. The final DOT relocation package was substantial, totaling $680,000 and including curb and gutter construction, a paved road (instead of tar as the county wanted), and extension of water

and sewer from Acme's line. In the final agreement, the residents received more land than they originally owned as well as common recreation land with a basketball court. In addition, they received a $5 million indemnity bond to cover damage to the houses due to the move for up to five years after the move.

Subsequently, Oakdale's town well water, which was still supplying the Appleton community along with the Acme-inspired line, was shut down because harmful levels of naturally occurring radium were found. So the Acme line headed off a major problem for Oakdale. Subsequently, too, the Appleton Community Development Association with the help of Planning Director McBride's successor applied for and received a UDAG of its own containing over $700,000 for improvements, including those much-needed sewer and water connections to the Acme line.

Don Mahoney, director of supply at Acme, greatly credits the company for helping get that grant money in place. "I can say that Robert McLaughlin [former human resources director at Acme] utilized available resources, internal and external to the managing partner Holbrook, to get the appropriate people writing and developing the grant," Mahoney says. "To get them to write the right kinds of thing and the right kinds of forms, etc., to have a high probability of approval. We also said that we would allow attachment."

In retrospect, Crane believes that Acme's push to help Howard Heights was in large part influenced by the fact the delays in settling the the conflicts were becoming increasingly costly for the company that was pressured by a production schedule that said that the first engines must roll off the line July 1, 1983. Acme officials would agree. When talking about the lessons learned from the incidents surrounding Acme's location and Acme's active involvement in ensuring that its location would be as smooth and undisruptive as possible, Don Mahoney says that, "when you go to a specific place and you have a specific purpose and it's to build engines and to serve customers, if you can avoid elements that make you expend energy that isn't related to that, that seems to make good [business] sense."

Susan Perkins adds that "they [Acme] are neither devils nor angels. I think that if you put them on a corporate scale, they're a lot more responsive then a lot of corporations around here. They have influenced the County, and they have influenced the Chamber to move in a more progressive direction."

Race Relations

"I think a lot of people felt the company [Acme] was coming in to sort of change things in the South," says Washington County Commissioner Bob Stills about Acme 's relationship with the communities outside the plant. "Now historically the Holbrook Engine Company is of that nature. They are promoters of good will and good relations. And they strive hard and they give an awful lot of money to support their positions and encourage participation....But they do have some strong beliefs."

Everyone outside the plant adds a qualifier of some sort when talking about Acme Engine's standing in the community. Advocates of the poor and the minorities would like to see more coming from Acme, while the business community would like to see less, especially those actions that relate to Acme's proactive stance on racial issues. At the same time all involved share respect for a company -- one from outside the area -- that unquestionably takes more active responsibility for its community than most.

"They are generous, they support some wonderful projects. So I am not being critical of Acme at all," says Tom Greene, partner in a local insurance company who was active in recruiting Acme to Washington County. "Their hot button is racial equality and they're really concerned about that. And that's fine, I have no problem with that, but I'd much rather see them work within the structure set up by the business community rather than freelancing."

Freelancing refers to the fact that Acme does not participate in the business community's annual fundraising drive for the local, small, liberal arts college just outside Rolling Hills, because its 47 fulltime and adjunct faculty are all white. Freelancing also refers to Acme giving back its corporate membership in one of the two local country clubs, both of which are segregated. But Acme has also been working postively with the college and Country Club to foster better relations.

Greene believes that the local business community, which played such an active role in attracting Acme to Washington County, felt somewhat betrayed by Acme. After personally signing $15,000 bank notes to secure land Acme wanted, the business leaders expected a kind of fellowship in return. "I guess it's the difference between a courtship and a marriage," explains Greene. "But Acme made some people mad....The thinking is, and I'm not so sure they're wrong: Acme, you pay your dues and you come in here and work within the structures we have set up to do certain things. Don't come in and say 'it's

going to be this way or no way at all.' Because first of all, it just ain't the way you get things done and secondly, it just creates a little animosity."

"The people here wanted to take a very paternalistic approach to Acme because of those kinds of monies," counters Joseph Conroy, director of Human Resources at Acme. "And we're saying 'no, we're going to run our business the way we think we should run our business.' And that is going to impact the community." Davies adds that the initial attitude at Acme was simply to stay within its four walls, make engines, and not get involved. But that strategy did not work because the racial situation in the area affects not only external operations at Acme but also internal.

"I'm based in this plant for one reason only, to make sure this plant is successful so I can make as much money as I can possibly make," explains Davies. "But for me, it's about business. And some of the things that we are having to deal with, [at the Country Club], the environment that surrounds this facility, get in the way of us running this facility." David Nickerson, former executive director of the Holbrook Engine Foundation, further explains that some of the difficulty Acme has had in fully implementing it seed concept, a radically new form of production and work organization, is due to the fact the Acme managers have had to spend so much time and energy on issues external to the company -- racial tensions, the local school issue, the relocation of Howard Heights.

Conroy explains that the racial situation "perpetuates an attitude and some very structural things that keep us from attracting and retaining top notch people, black and white." Davies, who is black, agrees. "I had some reservations about coming here at first....If I had known what I was going to be facing, I never would have accepted this assignment. That's where I'm at personally. And I've said that to quite a few people, including the president of Holbrook Engine Company. Because it just takes too much energy to talk about the kinds of things that I demonstrated for and sat in jail for back in the sixties, and to get to a point in my life now. I live on the eighteenth fairway at [the Country Club] and I can't play golf here." Yet Davies and Conroy, together with Acme management, have expended that energy and are working to effect change in the area.

Acme withdrew its corporate membership at the Country Club once it realized that blacks were not welcome. The company also will not be represented at functions held at either club. Robert McLaughlin recounts how the general manager at Acme was recently invited to a luncheon at another Country Club to welcome the new president of the local

state university. The general manager wrote a letter declining the invitation, making explicit his refusal to participate in any function at a segregated club.

But when Acme withdrew its membership, it let individual employees decide whether or not to hold private memberships, and that led to problems within the plant. "People who were leading this facility, the COT, maintained private memberships and that got in the way," explains Davies. "It caused people to divide. You're out participating in an organization that practices segregation in the evening and on weekends, and you're going to come in here and tell us that we're all going to work together? Man, that's a joke."

In addition, officials at Acme believe the unresolved problems with the school situation, inextricably tied to the racial tensions in the area, have also hindered their ability to recruit talented people to the company. "All along we've been saying it [the school situation] is an economic development issue," says Robert McLaughlin, former director of Human Resources at Acme. Acme has contributed $15,000 to a local committee of private business leaders who have realized that the school situation is economically detrimental and are working to develop solutions to the problem.

Acme does not have a formal public stance on what to do about the area schools, except that the issues must be resolved. Officials of the company have been working to develop a more cooperative relationship between the company and the local liberal arts college. While at Acme Robert McLaughlin participated on the search committee to find a new president for the college. In addition, Acme has provided resumes of potential black candidates, including spouses of Acme personnel. Dr. Harry Vickers, who became president of the college in July 1987, says that under his leadership and with help from Acme, Wesleyan is taking a more "deliberate approach" to recruiting black faculty. "Acme Engine had made its point that it wanted to be active in the college. It wanted to be supportive. I met early on with their representatives, and they said it was part of their company policy that until we had black members on our faculty they could not be supportive." Vickers says that Acme has offered to help identify candidates, pay faculty expenses of moving to Washington County, and stay involved in recruitment discussions.

Conroy and Davies both believe that working constructively with the community and its educational institutions will benefit everyone. "There's a great benefit that can be derived in both ways. Considering the amount of technology that we have in this facility, we've always got somebody in here training on something, teaching us some kind of skill

on our computers or whatever," explains Davies. "The college could be benefiting if we had that kind of relationship. We could also be benefiting, doing some co-oping. When students leave [school] they come to work for us. We would get a leg-up [by attracting] some of the best students."

Acme's presence in the community stirs up the issue of racial equality because Acme has brought a number of middle class, often mid-western, blacks as both managers and resources. Their presence is forcing Washington County to confront some deep-rooted structural inequalities. Even businessman Tom Greene acknowledges the problem when he talks about the difficulty in attracting black faculty to Washington County. "Who they gonna socialize with? Rolling Hills ain't Atlanta."

Reverend William Stone, an Jefferson County commissioner and Rolling Hills black community leader, talks about some of the disappointment local blacks have had with how Acme blacks have failed to integrate into the local black community. "We wish that some of the upper management blacks could integrate into the community more, [but] I think they've been headed off. They've been placed in committees in the city that no local blacks have ever been. And there's no problem with that, but we'd like to see them in our churches, identifying with the masses. That's happening in part but not enough....Acme was perceived as the great hope, and it didn't quite pan out. There are people in the black community that say 'If we can get together, we can make this a better place.'"

John Horhne, of Holbrook Engine Company says with hindsight, "My feelings are that we -- the two partners and Acme -- should have devoted more attention earlier with the community leaders to correct some of the issues around the schools and country clubs that are now in our way. What I mean by in our way is we've got an integrated senior management team that needs access to integrated country clubs and an integrated workforce whose kids need a good education and open schools. The fact that these things are not already in place gets in our way."

"The whole issue around treating people fairly and EEO laws, etc.," adds Conroy, "is to get rid of all the artificial barriers that keep people and institutions and organizations from being as productive as they can be. That's the issue."[1]

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[1] Acme's constructive efforts have paid off. Six months after this case study was conducted, the Country Club admitted its first black members and the small liberal arts college hired its first black faculty. Acme continues to support positive and cooperative relations with its community.

Economic Impacts

The fiscal importance of Acme to Washington County is undeniable. It is by far the largest taxpayer, with a total assessed tax value of $215 million. The second largest taxpayer has a tax value roughly one-quarter of Acme's. In addition, employees purchases goods and services locally such as houses, cars, and services because of Acme. What community leaders accurately envisioned in that era of Acme recruitment was proportionately higher tax income from the firm because of its state-of-the-art equipment. At the time, Washington County had a tax base of a mere $800 million, and officials were anxious to broaden the county's tax base by 43 percent in one fell swoop.

Acme's highly automated production and accompanying organizational strategies have not triggered any similar changes among other local industries. According to Henry Scott at Washington Community College, two other local firms have introduced automated equipment, one with an automated warehouse facility with a storage and retrieval system run by robots and computer controlled material handling equipment, the other by introducing computer controlled equipment and using the Oakdale branch of Washington Community College to train employees on the new equipment. "Acme didn't bring [automation] here," says Tom Greene. "But I think that because of Acme, [the other two plants], and the training facilities...that highly automated plants will bloom."

The Oakdale branch training facility has become a major cornerstone of the area's economic development strategies. Scott and Jane Black talk about the visitors from all over the world -- Egypt, Korea, and Japan -- to the training facility. Scott believes that subsequent growth in the area is due not to Acme itself but rather to the infrastructure put in place for Acme, namely, the training facility and the water and sewer line. "Now I don't believe we would have gotten the aerospace division of [a major corporation] had we not had this training facility," says Scott. "Now you see something else we created. We created a four and a half mile long industrial park by putting water and sewer.

Scott continues by talking about the benefits to the communities immediately surrounding Acme Engine: an upgraded fire department, three doctors instead of one, a medical clinic; a dentist; and a rescue squad. Acme purchased a mobile home for the town of Oakdale to house the local rescue squad, a satellite facility of a Rescue Squad in Rolling Hills. In addition, Acme purchased a heart attack machine, a defibrillator, for the Oakdale Medical Center in exchange for the Center's cooperation in working with injured or sick Acme personnel. "I'm glad Acme is there," says the Oakdale Mayor. "I wanted it to come

there. I've heard people say 'What has Acme done for Oakdale?' I say, 'What has Oakdale done for Acme?'"

The idea that Acme was going to trigger what Tom Greene called "a world of small entrepreneurial enterprise" suppliers and buyers sprouting up as a result of Acme's location in Washington County, however, has not materialized. Acme, by its own admission, is not linked to the local economy. Don Mahoney, director of supply, says, "We did not come in with any intentions of establishing a local supply list. We came in here with the intention of being the most competitive worldwide manufacturer of engines, sourcing components from wherever in the world we could find them to be cost-competitive. Currently, 50 percent of our product is sourced from international suppliers."

The main project of the Holbrook Engine Foundation dealt with the issue of local suppliers. According to David Nickerson, the foundation's former executive director, the foundation's concern was "what would this major investment do for the low-income and particularly black populations...How could the foundation help the black community take advantage of the [economic] opportunity of such a major plant?" The answer, or so the foundation officials thought, lay in developing a supplier/buyer relationship with Acme, developing industries as opposed to funding traditional charitable projects..

Acme quickly learned that local suppliers, regardless of race, just did not exist in the capacity Acme required. In conjunction with other private and state foundations, the Holbrook Engine Foundation established in 1983 a minority business development program serving a rural region of the state. Holbrook was the catalyst for developing the program and worked to convince other funders that there was a need for such a program. From 1983 to 1987, Holbrook has contributed $100,000 to the project.

As Nickerson says, however, that although many small businesses have been established and supported as a result, very few suppliers to Acme have come about because of the program. "It hasn't panned out at all locally." The main reason it did not work, explains Nickerson, "is that Acme operates under a different quality standard." The nature of Acme's production requires components that meet extremely exact specifications and that can be modified quickly to reflect Acme's constant product changes. The disappointing story of the program raises hard-to-answer questions about how low income and minority people can take direct advantage of the value-added process of such a large, highly automated manufacturing facility like Acme. Susan Perkins also sees that as a problem, saying the large plants are more likely to promote regional growth, in the aggregate, but

they do little to develop the economic potential of neighborhoods and communities, particularly distressed communities. She adds that local economic development strategies have to focus not only industrial recruitment but on community-based development strategies as well.

Nevertheless, because of Acme's impetus, a viable and successful minority business assistance program has begun. In addition, Acme has fostered one new minority business, separate from the program. According to Mahoney, Acme has been involved with nurturing "an individual that we felt demonstrated through the businesses that he owned -- which were predominantly service-oriented -- to have the right kind of management capability, technique, initiative and drive" to become involved in heavy, precision manufacturing. Acme basically promised to buy the person's parts if he would locate within a 60-mile radius. Two years ago, he moved from Washington, DC to a nearby town where he purchased a small, electronics going concern. As Nickerson points out, this person is an entrepreneur, an MBA with a significant amount of capital behind him.

In return for quality parts on time, Acme provides the new company with use of a $60,000 tri-axial coordinate measuring machine, technical assistance in the form of resources working at the new firm, letters of recommendations for SBA loans, and letters of intent to secure other financing. "The intent is that we would be the receiver of the incubator concept," says Mahoney, who adds that the new firm's customer base has grown since it has been able to demonstrate, through its relationship with Acme, that it can produce on-time quality parts at a competitive price. Acme does have two major minority suppliers from whom it purchases direct engine components -- one located in Georgia, and the other in Durham, North Carolina -- but according to Mahoney, "Those are established suppliers that are viable businesses in a large way. I don't think of them as a minority supplier, they are suppliers...no different from anyone else."

Automation and the Schools

"I think there is a crying need in this area, let's just say in this region of the state, for technical training, " says Robert Landau, performance support manager for Acme Engine. "That's both the fundamental, nitty-gritty basics, and preparing people to get into higher level jobs. There are people at various levels in our company and in other

companies and in the community who are about to the point where they can begin addressing that.

"What I'd like to see is the technical schools not letting up on developing the technical aspects of their colleges because they are now community colleges. I would like to see them do both. And I'd like to see a consortium of community colleges in this region, with business and industry leaders working together to overcome the technological deficit, the industrial training deficit, that I think we're into."

Because others in the area see this deficit too, changes in education are underway in the Washington County area:

- The president of the 1,500-student liberal arts college in Rolling Hills, is setting up an internship at an area firm for his computer science students; he hopes more industrial internships are on the way.

- In an industrial survey, Washington County schools' vocational personnel determined that machinists and electricians are the area's greatest need and that to get them major employers are ready to evaluate vocational curricula and offer co-op opportunities.

- Washington Community College last summer was the focus of a state agreement smoothing the way for Washington students with two-year associate degrees to transfer to state universities to complete their bachelor's work.

Many educational sources are in agreement that the community colleges and technical schools should have stronger liaisons with research and liberal arts institutions. Such networking is answered nicely by the liberal arts college's fledgling program. In addition, Washington Community College President, a member of the business community's education committee, reports that efforts are underway to create more links between the area and the state university.

Further, the Southern Technology Council, responsible for the present series of case studies on automation, is planning a consortium of two-year postsecondary schools that would bridge the technological transfer gap between research institutions and manufacturers, between the producers and the users of new technologies. Landau, the Acme manager, says he likes the idea of a "consortium of community colleges" pooling their resources to improve vocational training. The example he cites, unfortunately, is one which never took off -- the Oakdale campus. After Acme finished its program there, Landau says, "The notion we tried to foster was that the four community colleges in this

area should have been able to use this facility to increase their course offerings." That notion, Landau acknowledges, didn't generate much interest.

In the Rolling Hills area, education has also become an economic development issue. Racial tensions are more evident because of the controversy over school merger, and as the region changes from a rural tobacco farming culture to a manufacturing/high tech center, education becomes an economic development issue too. Some companies refuse to consider the Rolling Hills area as a site for a new plant, and some existing companies are having trouble attracting personnel because of the problems in the community. Racial tensions have affected Acme Engine Company since its arrival, getting in the way of its ability to recruit qualified minorities in the area according to Vice President Horhne of Holbrook. In turn, Acme has played a public role in addressing the area's equity issues and has in some way forced other business and political leaders to address the situation as well.

Susan Perkins, executive director of Legal Services, which advocated for the Appleton and Howard Heights residents, explains how education as an economic issue should concern the community too. "The whole school merger thing is tied to economic policy, and it would, depending on which way the merger goes, fuel or stymie -- depending on which county you're in -- economic development," Perkins says. "The discussion is really about boundary and turf and power. It's not about what's going on in the classroom."

Education is tied to economic development in the Rolling Hills region because of industrial executives' reaction to the local school situation, especially the following factors:

- an imbalance in the resources available in the four school systems;
- the perception, accurate or not, that predominantly black schools are inferior schools;
- the boundaries of the districts covering primary and secondary schools not being coterminous with city boundaries;
- territorial disputes among the two county and two city school systems;

Education also becomes an economic issue in the larger sphere, in terms of the kinds of vocational decisions being made in the area and in terms of the increasing need for

links between liberal arts, academic, and research institutions and industry. Significantly, when Harry Vickers took over as president at the liberal arts college last summer, he was undaunted at the poor relationship between the college and Acme. Instead, Vickers, who himself obtained a liberal arts degree before embarking on an academic career teaching business ethics, set out to improve that relationship.

"That's one of the things we think is a big piece of the future of this college," Vickers says. "What is the role of a liberal arts college, especially in a region facing the need of economic transition?" Vickers answers his own question. "The value of liberal arts is that kids can think and communicate and solve problems and are able to deal with a wide variety of cultures and problems. That is what liberal arts is about. We want to deal with local industry not only to help our students but to help our region grow, to keep it attractive."

Here, Vickers hits the crux of the relationship between education and economics. A healthy, racially and class-balanced school system is a powerful draw to industry. More important, it is the appropriate means of training for the skills required by modern industry -- good communication skills, problem-solving ability, and a level of knowledge that provides the confidence and ability needed to look at a question and come up with the best answer.

Conclusions

In many ways, Acme Engine Company's use of high technology production processes and innovative work organization represents the future of manufacturing and poses many of the issues that need to be addressed if manufacturing in the rural South is to advance into that future. At Acme, production technology is almost secondary to the management strategies that accompany that technology, and both are inextricably tied. Competitive Effectiveness depends on people, and the underlying assumption in Acme's technician-based work organization is that flexible, automated production requires (1) new and greater skills and therefore a new type of training process, (2) a rethinking of traditional relationships between managers and production workers, and (3) continual learning and skill development.

In trying to realize its initial concept -- the seed concept -- Acme encountered an array of obstacles. Some were due to changing market conditions and the need to be able

to quickly respond to those changes; others were due to the community context in Acme found itself. The plant was originally designed to produce one type of engine, but during the three and a half year lag time between the legal creation of Acme and its physical creation, the engine market was unexpectedly transformed, and customers were demanding a variety of engines. Also unforeseen was the fact the production schedules left little time for an essential component of Acme's original design, namely the transfer of skills from resources to technicians.

The local labor force may have met Acme's "blank sheet " concept and "fuzzy" hiring criteria -- communication skills, an ability and willingness to learn, and self-accountability -- but it came up short on basic skills, particularly math -- a situation that Bob Landau claims is still hurting Acme. Closely tied to the lack of math aptitude and basic manufacturing skills and changes in production , Acme was unable to develop, as quicky as it had expected, the breadth *and* depth of skills among technicians. As a result, Acme imported the critical machining skills it needed from the Midwest. Less of a factor, however, is the contention that the local work force is used to, and therefore works better in, a supervisory or foreman-type environment. On the whole, the teams at Acme have been successful in managing themselves.

Acme also faced obstacles that stemmed from the community in which it located. First, racial tensions and economic disparities within the greater Rolling Hills community have resulted in an overall economic development climate that not only deters potential industry and new business formation but also hinders the success of existing industries. Acme officials, with a corporate tradition of playing an active role in their community, expended extra amounts of energy on the unanticipated and divisive issues outside the company's four walls, sacrificing the extra energy needed to get a new business up and running.

All of the above conditions have influenced the organizational changes being effected in Acme's Renewal Process. Acme's organization is changing, and some might claim it is growing more traditional, yet it remains fundamentally different from its neighbors in eastern North Carolina. Acme may have taken a step back toward a more conventional workplace, but it was so radically different initially that the end result is still a very innovative work structure, with highly skilled people accustomed to on the job responsibility, sharing a commitment to learning, and sharing a sense of responsibility for the company through an understanding of world economics. Had Acme not started with its seed concept, its step toward more traditional plant functioning -- a step that accompanies

every plant making the transition from a start-up to an operational facility -- may have resulted in a complete loss of innovation.

Acme is making waves in Washington County. According to Acme's Lynn Schmidt, the company's ideas about workplace organization, "the mere fact that it was different...created questions for the citizens, animosities." The company's ideas about education and training have confused and at the same time altered local technical education, at both the high school and post-secondary levels. The company's ideas about racial justice have brought to the forefront, in a sometimes confrontational way, many of the structural barriers to racial equality enmeshed in the community, and they have affected how both the local business community and the local liberal arts college operate.

In addition, the incidents surrounding Acme' arrival in Washington County have, in the final analysis, empowered the communities of Howard Heights and Appleton which experienced for the first time local government responding to their concerns. According to Susan Perkins of Legal Services, "I think there is a tremendous sense within the black community and low income community that we need to have our own economic agenda. And when corporations come in in the future, we need an agenda that's already set and says here's what our concerns are....This incident [the recruitment of Acme to the area] and some other things [including Voting Rights legislation] have really crystallized the fact that concerns and policy have to be adjusted" to meet the needs of low-income and black people.

A major catch like Acme Engine Company brings with it enormous economic benefits, to be sure, but there are lessons to be learned from the exagerated recruitment hype that drew up lines within the community. Company officials were led to believe that Washington County officials had the relocation situation under control when they did not and that the school controversy was less severe than it actually was. Local officials put off addressing the needs of those residents most immediately impacted by Acme until those residents demanded they be heard. In the end, if the Acme experience taught anything, it was the need for respect between people -- between northern factory philosophers and southern business leaders; between political leaders and community home-owners; and between industrial recruiters and the local citizens.

CASE STUDY VIII

NEW OWNERS AND OLD PROBLEMS: *MAKOTO INDUSTIES*

by Carol Griffee

Setting the Scene

The recent history of the South's present manufacturing base goes back to the post-war years, when mechanization of agriculture was proceeding relentlessly, forcing field hands, sharecroppers and small farmers in the south to leave the land for cities and factory work--often in the upper Midwest. In response, southern states developed industrialization campaigns that focused on attracting so-called "cut-and-sew" operations, shoe factories, consumer goods manufacturers, components producers, and others.

In October 1964, during the height of the industrialization effort, an American television manufacturing firm--the predecessor to the Makoto Industries plant--opened its doors in the agricultural heart of a southern state. The building was within sight of a planned interstate highway interchange in Ashford, a small city some 40 miles from a major southern metropolitan area. Two other industries, both makers of durable goods, already were located in the interchange quadrant. The city had passed a tax-exempt bond issue that enabled it to construct and own the building and lease it to the television company. The company supplied televisions to one of the country's major retailers, which in fact owned nearly a quarter of the new plant.

The firm drew its work force, which peaked at 2,800 to 3,000 in the late 1960's, from a wide area of the economically-depressed region, but the majority of the employees came from the Ashford and its home county, Walker. The plant is only eight miles south of the county's northern boundary, and a substantial number of its employees came from the adjacent county on the north.

The impact of this firm and the two other plants on the area's economy can be seen readily from Bureau of Census statistics. In 1960, Walker County had a population of 33,303, with 10,544 of them living in the city of Ashford. This represented a 38.6 percent increase over 1950. Forty-three percent of the county's residents were non-whites and the median family income was $1,973, or only 35 percent of the U.S. average family income. Only 19 percent of the county's total adult population (over age 25) had completed high

school. In 1958 there were 743 manufacturing workers in the county and of these, 589 were engaged in making durable goods. The county just to the north, which shared a labor market area, had a population of only 19,551, of whom 30.2 percent were non-whites. The median family income was higher -- $2,480, or 44% of the U.S. average-- and the education level was slightly higher.

Even though the television plant was operating near its employment peak by 1970, the home county's population had dipped 7.5 percent from its 1960 level to 30,799. The median family income increased significantly relative to national figures during that decade. It was $5,532, or 58 percent of the national average, an increase which in part might be explained by the introduction of 1960's social welfare reforms. The county's civilian labor force totaled 8,914, with 42 percent working in manufacturing jobs. The adjoining county's population had edged up slightly to 19,783 and its median family income remained above Walker County's at $6,261. The civilian labor force totaled 6,296 with 28.8 percent employed in manufacturing.

The Sale

In October 1976 the large American company that owned 57 percent of the television plant announced that it would sell its share of the company for $10.3 million (later raised to $12 million) to Makoto, a diversified Japanese electronics firm. The Japanese company was making the first of what eventually became four investments in American manufacturing facilities.[1] The American retailer kept a 23 percent interest in the television plant, but the Japanese company said it would acquire the other 20 percent of the stock and move its United States headquarters from New York to Ashford. In the early 1970's, the television industry had shifted to solid state electronics, but the parent American company had been late to make this change.

The Japanese were welcomed to the state with an official reception and lunch hosted by the governor. The retailer to which the plant supplied televisions brought the parent company and the Japanese firm together, according to one of the plant's current long-time managers. The Justice Department did not contest the sale, and the plant, which had been closed for a week to execute the transition, opened under Japanese control on January 4, 1977.

[1]The other plants, none of which makes televisions, are in a Mid-Atlantic state.

At the time of the sale, it was stated publicly that the plant had 900 employees, and that there would not be "much of a change at all" among the personnel. Only part of this was true. An American executive with the Japanese firm said that the true number of employees, both salaried and hourly, actually was about 450. According to an academician who did a lengthy but aborted study of the plant in 1986, the Japanese made a conscious decision of "when in America, do as the Americans do," and did not initiate their own distinctive management techniques. Others report that the workers had no interest in changing. At any rate, Makoto negotiated a contract with the International Union of Electronic, Electrical, Technical, Salaried and Machine Workers, AFL-CIO, which was similar to or perhaps even better from the workers' standpoint than the one that existed before the sale. "We inherited [and kept] a very mature work force," an executive said.

A major elected city official noted that the area's manufacturing workforce had been heavily unionized from the beginning of the industrialization period. Others accused the union of serving as a "civil rights training ground" for its black members, and one academic researcher alleged that evidence of Ku Klux Klan activities had been found among some of its white members.

Expansion

In February 1978, Makoto Consumer Electronics announced it had entered the export field for the first time with a delivery of hardwood veneer cabinets to Japan and that regular monthly deliveries were expected. A manager of the American parent firm said at the time of the sale that one of the main reasons the Japanese corporation bought the plant was its woodworking section, which made wood veneer television cabinets. It was one of the few television producers that made its own cabinets. Exporting the cabinets to Japan was the firm's first venture into Original Equipment Manufacturing (OEM), the making and marketing of equipment other than for its own use.

In May 1979, the company broke ground on a $1 million, 80,000-square-foot annex for the manufacture of microwave ovens, a product that previously had been made by the firm only in Japan. The Japanese said the decision to build microwave ovens in America was prompted by the expanding market for the item, the cost of shipping ovens to America, and the exchange rate of dollars for yen that had made exporting unprofitable. The expansion enlarged the plant to more than a million square feet and created 200 new jobs.

The addition of the microwave oven lines accentuated the seasonal nature of work at the plant, which is slow the first half of the year and busy during the second half to fulfill orders for the gift-giving holidays. All but a handful of the production workers are hourly employees, and seasonal layoffs are customary, a fact that apparently is not appreciated by the news media in the state's capital. Commercial television in that city recently gave extensive news coverage to the mid-summer return of hundreds of workers, even though management pointed out that layoffs and call-backs were customary.

In the 1980, the population of Walker County was just slightly higher than in 1970 but the population of Ashford had grown considerably--10.2 percent over the last decade. The percentage of the 25-and-over population who had completed high school had soared to 45.1 and the median family income was $11,814, but still only 56 percent of the U.S. average. And 27.8 percent of the families were below the federally-defined poverty level, almost twice the poverty rate for the state as a whole, and three times the national rate. There were 3,100 manufacturing employees, 2,500 engaged directly in production work.

With the "boom" in the microwave oven market in 1981, the plant reached its peak employment under Japanese ownership of 2,300 to 2,400. Three complete management changes were made in the woodworking division through the years in an effort to get it to operate with "sound engineering principles." None succeeded, and when it became clear in 1985 that the company could buy wood products cheaper than could be made on-site, the division was closed and 300 hourly and 35 salaried positions died with it. Color televisions remain the plant's principal product with 1 million sets being assembled there annually, representing about 6 percent of the American television market.

The Work Force Today:

During the full-production season, the Makoto plant's work force is about 1,400, about 300 of whom are salaried. There have been no new hires in the last two years although the plant is located in a state "Enterprise Zone," which qualifies it for tax credits if it were to hire and train persons with a history of long-term unemployment.

About 70 percent of Makoto's current workers are female and about 60-65 percent are black. The average hourly pay rate is $7.55. Between 40 to 50 percent of the workforce live in Walker County and 20 to 25 percent commute from the adjoining county to the north. About 95 percent of the workers live within a 40-mile radius of the facility.

Table 1
KEY COMPARATIVE STATISTICS AT A GLANCE

Year	Population	% White	Median Family Income
Home County			
1960	33,303	57.0	$ 1,973
1970	30,799	52.7	5,532
1980	30,858	54.0	11,814
2000	33,664		
Adjoining County			
1960	19,551	69.8	$ 2,480
1970	19,783	72.0	6,261
1980	20,434	75.26	14,283
2000	22,106		

Source: U.S. Census Data**Automation**

It was inevitable, and the workers knew it. Concerned about containing costs, the chief American engineers at the Makoto Consumer Electronics plant in Ashford spent much of their formal and informal time together in 1981 and 1982 discussing what they felt constituted "the ideal automated production line." By their definition, automation is when any type of equipment performs automatically tasks that previously were done manually.

The local Japanese president gave the go-ahead for the formation of a task force or team that in August 1983 began working eight hours a day, everyday, planning the "ideal automated production line." The task force included a Japanese engineer who, in the words of his American co-workers, was "brilliant at putting concepts" into drawings on paper but lost interest after this was done.

The task force worked closely with design engineers because it would have been foolish to automate anything that was going to be eliminated from production within the next five years. Close liaison was maintained with the company's vendors to impress upon them the need for maximum standardization of parts because automated equipment has little tolerance for deviations. For example, a television chassis must stop before a screw-driving machine at an exact point, and the screw itself must be flawless. Otherwise, the screw not only will not go into the intended hole, but the machine's effort to insert it will damage the chassis itself.

Numerous hours were spent writing processes for the sequence of production because the engineers weren't just designing new machines or robots. They were revamping an entire production line, fashioning a "total system," that minimized the amount

of human movement up, down, and around the line. To the extent possible on the new line, it would be the product rather than the people who moved. People also were given greater control over the product's movement. For the television set on regular lines moves on a belt and an assembler has a given amount of time to install all of the parts for which she is responsible. If she isn't able to finish this in the allotted time, the set moves on anyway, resulting in a reject. Now the set stays in place until the assembler finishes the tasks and hits a button that moves it on. According to plant engineers, the result is a 6 percent rejection rate on the automated line, versus a 22-23 percent rate on the old line.

The engineers claim, however, that it is only the simple tasks -- such as probing for shocks to be sure that the products meet federal safety standards -- that can be automated. The simplicity of the robots' jobs leads engineers at the plant to refer to the robots as "pick 'n' place" machines.

After six months of intensive work, the American engineers submitted to headquarters in Japan their detailed designs for a totally new production system. In December 1983, the order was placed with another Japanese firm to construct the new system. At the time, company engineers explained, the Japanese were the only ones geared up to build totally new production systems, although Litton Industries in America recently began to do some of this work.

The word came in the spring of 1984: the Japanese manufacturer had finished making the system and it was "ready to be checked out." A half dozen Americans -- three engineers and three technicians -- spent 14 days to a month in Japan learning how to program, operate and maintain the equipment. When the group returned home, each was responsible for teaching one other individual what he had learned. In addition, salaried engineers and technicians provided on-the-job training for persons designated to unjam and otherwise supervise the equipment as it was operating. These people were required to have training in basic electronics and they constitute all the new hires added as a result of the new automated lines.

The community in which the plant is located boasts both a state vocational-technical education school and a community college. Company engineers said, however, that they have had more success recruiting persons with needed training in basic electronics from a private technical college in the state's capital city and one located in another southern state.

According to a company official, the local public vocational education school has some very limited electronics courses, speculating that it was "probably because they lacked qualified instructors." The school, he added, "has called here asking some of our people to teach and they have taught a few." The official was unaware, however, that the local community college offers an Associate Degree in Applied Sciences in Electronics.

The Five-Year Plan

The three-phase automation program was to be a five-year that would begin with one production line being installed and thoroughly tested. If satisfied, the company would install two more lines the second year and put more automated equipment on the first. In the third year, the equipment added to line one would be installed. More automation would be added to Line One, the designated test site. Automation of the first line was to be completed in the fourth year with the equipment added in the third year installed on lines two, three, and four. By the fifth year, the company contemplated having five of 12 lines fully automated.

The equipment did not bring a simple one-on-one replacement of people. Frequently it allowed two jobs to be combined into one with the result that the number of workers on one line was reduced from 79 to 58. The chief operating officer said that no more than 60 workers in all were replaced by machines, though only about 40 percent of the proposed five-year investment plan has been carried out. Workers with seniority shifted to other tasks and hourly employees who were no longer needed were not recalled from seasonal layoffs.

Some workers, including the union president, openly resent the replacement of people by machines and reveal this in the relish with which they tell tales about how the screwdriving robots go wild and "spit screws all over the place," and how a human being has to sit next to the machine to put in the screws that it misses. Company engineers say they are pleased with the automated lines, maintaining that the equipment operates 98 percent of the time. More importantly, a line that produced 2.3 units per person day in 1983 produced, with automation, 19.7 units per person day in 1986.

Disruptions in the Plant

Even so, the five-year plan has not been fully carried out, and it is unknown at this time whether it will be resumed. The program became a victim of a 21-day labor strike in 1985 that has left a legacy of bitterness and distrust among all who were involved --

Japanese management, American management, the workers, the community, and to a lesser extent, the state.

Japanese management, according to the plant's chief operating officer, an American, decided it didn't want to invest any more capital in the facility until it could better judge the seriousness of the situation and develop a prognosis for stabilizing the labor problem. The industrial engineering manager said he had included $3 million to $5 million in his requested budgets during the last two years but had been advised there was to be no new capital expenditures, though he had never been told it was a result of the strike.

When the automation program was halted, 20 robots were in use along with seven computer-aided drafting work stations and four computer-aided design work stations. The computers are used to program and operate the lines, with one dedicated to training. About five of the plant's 32 engineers are at various stages of learning to operate the computer work stations. Although this constitutes about 40 percent of the planned automation program, the plant's chief operating officer says that this is about the average amount of automation in the industry as a whole.

There appears to be a consensus that automation played no part and was not a contributing problem to the strike. An executive acknowledged that critical labor problems existed at the facility before the walkout. In fact, the company was hit by a strike in 1979 that one executive estimated cost the firm $50 million in concessions from that year through 1985.

Although it is not the intent of this study to analyze the strike, some observations can and should be made to the extent that the strike affected the implementation of automation at Makoto. There was some violence (rocks through a car windshield) and even more chilling threats of mob violence that are said to have thoroughly shaken and embarrassed the Japanese. The city's chief elected official, speaking with two years of hindsight, asserted that the union had been "barbaric" and that management had been "childish." Be that as it may, the strike and the bitterness it generated tends to dominate any discussion about the company, rendering objective assessments impossible from those who were involved. The bitterness hangs like a pall over the plant and the community. Labor and management each seem to feel it is being held hostage by the other. An academician said this continues a pattern that she encountered when she attempted to do an earlier study about the strike. Her study had to be aborted because of union unresponsiveness.

Worker and Community Reactions to Automation

The machines? "No, I don't like the machines," the union president, a worker at the consumer electronics plant since 1965, said without hesitation. "They take our jobs."

However, the union leader doesn't feel he's been touched personally be the automation. For two years before he became the full-time union president in December 1985, he drove a lifting truck in the finished goods warehouse. A new automated conveyor there does some of its own sorting and that has eliminated some jobs. But his old truck-driving job is still there.

Before moving to the warehouse, his job had been plucking pictures tubes from an overhead conveyor and placing them on a table where brackets were attached so that the tube later could be connected to the television set. He said this work, which is physically demanding, had been automated, but he did not speak in the context of this personally affecting him.

Before automation, he recalled, two operators on the microwave oven line would lift a unit and place it on its bottom pallet. Now one person operates a machine that lowers the unit to the pallet. "It affects me to see someone else being laid off," he said.

Has automation affected the community? "Sure it has," declared the city's mayor. "There are fewer jobs out there." The public official, who worked several summers part-time at the plant before graduating from the state's main university, went on to say that all but one of the industries that had located in his city during the 1950's and 1960's were now in trouble. His county, he said, had led the state in unemployment with 20.8 percent rate for the last 18 months -- 13.2 points above the state's unemployment rate in August 1987. The consumer electronics plant was Walker County's single largest employer, and he shuddered visibly at the thought of anything happening to it.

"[Automation] may seem on the surface to be a bad thing," he continued, "but I think automation is critical for the retention of jobs. Companies can't use American labor for simple assembly line tasks anymore and compete with Mexico and Korea. It's automate or go out of the country." The official, who is in his thirties and has been in office seven years, is aware that the local plant already has lost some of its 13-inch television assembly to a company plant in Mexico. In fact, some engineers from the local plant helped install the production lines at the Mexico facility.

The union president was asked to respond to the official's argument -- that all jobs would be lost with automation. "If you had all machines, there would be nobody to buy the product," he replied.

Another worker, a woman who had been at the plant since it opened 23 years ago, also said that automation had not touched her personally even though she worked on one of the three automated production lines. That's because her particular job -- putting knobs on the sets before they go on the conveyor for assembly -- had not been eliminated, the union president explained. She said she was hurt emotionally when others lost their jobs to machines because they were her friends.

For the first ten years of her career at the plant, she inspected the insides of television sets, looking for shorts and missing parts. Then, she said, she elected to become a permanent Grade 1 knob installer earning $7-plus an hour because she did not want to shift from task to task, which would have been her fate in higher grades under the union contract. With production changes or layoffs, those with ingrade seniority "bump" others with less seniority to other jobs, similar to the way RIFs (reductions-in-force) work in the federal government. "I like my work," the woman said.

The complexity of her job varies depending on the television model being produced. "Some models are easier, some harder," she said. Others who actually are on the line, she observed, "work harder than they used to because the line is faster."

A manager who works in the plant personnel department and who heard the interviews with the union president and the woman worker commented later that "very few [of the workers] will concede that there has to be some automation." He went on to tell about a "strange" change in attitude that he said had occurred recently at the plant. "[Worker] morale is up when there's every reason for it to be going in another direction," he said.

One of those reasons is that the union had agreed to freeze wages for a year. The company also wanted to tighten attendance rules, and when an agreement couldn't be negotiated with the union the new rules were initiated anyway. Production and quality are up, the manager reported, and attendance has improved nearly one percent.

He believed that labor unions were going to have to give companies more flexibility in assigning workers. "You want people to be in the best places for them [doing the jobs they perform best]. As you're changing, you need people to change with you." He

empathized with union leaders who, he said, are beginning to recognize this but who have to practice adversarial rhetoric "to keep up appearances before their members."

Education and Other Problems

When the consumer electronics production plant opened in 1964, only 19 percent of the county's adult population had completed 12 or more years of school. Much of the labor force in that decade consisted of persons who were the first in their families to live and work somewhere other than on a farm. Further, some 70 percent of the plant's workers are women, most of whom were reared in a period when society discouraged them from being ambitious or assertive.

Education -- or the lack of it -- has long been perceived as a labor problem by the company. The chief operating officer said the company made a high school diploma a prerequisite to be hired because the company did not want to perpetuate the low educational levels.

There is a community college nearby and some company officials have worked with the local community college designing curriculum for management. Management admits, however, that it does not " do much" with either the college or the vocational-technical school in the vicinity. It doesn't fault either institution, though, because both have offered repeatedly to help. "They have certainly tried, but there's not a whole lot of interest by the employees" for postsecondary education "unless they're paid". The spokesperson said some of this might be attributable to the seasonal nature of the plant work.

An administrator at the 20-year-old vo-tech school confirmed that this was what the company had been saying for years. He also said, however, that American management at the firm had projected the image -- true or not -- that it "doesn't value associate degrees and does not have much use for anybody without a college degree."

Automation as De-skilling

Considerable simplification of assembly work at the plant has taken place over the years. It used to be, for example, that many wires had to be soldered and otherwise connected in making a television. With the advent of solid state electronics and other innovations, and with most of the parts coming from Japan, the number of wires and other components have become fewer and fewer. "Now you basically have to plug up two parts," the company spokesperson said.

Through a combination of design changes, reorganization of production, and automation, productivity measures have improved dramatically. It used to take 135 work stations and 90 seconds per work station to complete a set; now it takes 50 work stations and 30 seconds per work station. "That's a de-skilling technique," the spokesperson explained. The actual manufacturing of televisions has been replaced by assemblage. Subsequently, the company has reduced direct labor costs from $13 per unit to less than $5 per unit as a result of these changes. In 1980, average production was 2.35 units per employee per eight-hour shift. In 1987 it is 13 units per employee per shift.

Virtually all training is done within the plant for a three-tiered program. It takes 40 or fewer hours of both classroom and hands-on training for a basic assembler to develop and maintain speed and quality. The company has 12 to 15 salaried employees stationed at any one time throughout the plant -- in production, quality control, and engineering. Their principal jobs are to service equipment. A few older, experienced employees without degrees fill some of these positions, but "we have tried to stay with associate degrees" for this, the CEO said.

Another group of employees roam the production lines to "unjam" equipment as needed and determine when repairs are needed. These are hourly employees who must pass a mechanical aptitude test, but otherwise receive only on-the-job training of at least 40 hours. Still another group of hourly employees work exclusively on the products, not the production equipment, to troubleshoot faulty television sets or microwave ovens and repair them. Employees apply for these positions and, if chosen take about 400 hours of in-house electronic and technical training. This "open bidding" system allows any employee to qualify for any available.

Twelve Is Not Enough

Although the percentage of the county's population with 12 or more years of schooling has now reached about 45 percent, it is still nearly 50 percent below the national average. (More about expenditures) The company's chief operating officer believes that the education problem won't be overcome until public schools are supported wholly from state sales tax revenues, dropping the local property tax as a source of support.

The lack of education is viewed by the city's chief elected official as the area's main hurdle to economic growth and stability. "You can't attract industry by bragging about available labor force anymore," he lamented, especially when production.processes and

equipment have become more complicated, competition more intense, and the labor force has a reputation lacking ambition for education and skills improvement. In fact, he said, the highly-unionized, highly-uneducated nature of the labor force cancels out any advantage the city might have because it straddles an interstate highway.

The Welfare Cycle

"It's a sad fact," the official continued, "but almost anybody realized we have third generation welfare here" and the consequences are becoming more apparent. "There are youth gangs in the public housing projects now for the first time," he said. Most public officials are reluctant to talk about such matters because they fear being accused of "racism." But, he said, "this is a problem that crosses racial lines."

"Education is the key, but breaking the cycle can't be done in a year or two," he said, shaking his head in frustration. "I don't know the answer," he added. He went on to volunteer the information that he hasn't given up because he has hope for the National Governors Association's new welfare reform proposal and he suggested that a Works Progress Administration-type program might provide at least a partial solution.

Further, he said that the area's workers not only lack basic reading and math skills but most "have no concept of how business and the profit system work. Most of them have no concept of why it is important for them to help the company make a profit...they think the company is here to provide them jobs, not that the jobs are here because the company makes and sells something at a profit." Told that the state has a highly-touted economic education council that spearheaded such teaching in the public schools, the official declared, "Then the council needs to get active in this area...there's got to be some basic business education."

Community Relations

Despite frustrations, the officeholder said the city remains committed to promoting economic development as demonstrated by the fact that $20,000 is still budgeted for this purpose even though municipal revenues were down $367,000 in the first five months of 1987 compared to the same period in 1986. The loss is largely attributable to reduced federal revenue sharing and state turnback funds, the latter reflection of tax revenues that have been below projections.

The officeholder said he believes the company has lost confidence in the community's leadership. If so, it is not without cause in the minds of company officials. The mayor pointed out, however, that neither the Japanese nor the American management had ever made much of an effort to be involved in civic affairs. For example, he said, no company official is a member of the Local Rotary Club, and only one is on the Chamber of Commerce. He indicated this may be one reason the Labor Council remains "the most potent political force" in the area and is "50 times more effective than the Chamber." Even a stranger on a first visit can pick up on a palpable sense of isolation at the plant.

A World Beating

The plant's five-year effort to reduce direct labor costs through automation ran aground on the 1985 strike and Japanese management's decision to defer additional capital investments until it had a clearer picture about the facility's future. There are, at the minimum, two other factors that are contributing to the murkiness of the picture at this time, and both are beyond the local plant's control.

One of those factors was brought up by the plant's chief operating officer when he noted that "our industry [the consumer electronics industry] over-all has a major problem." Product prices, he explained, "have eroded to the point where not one manufacturer is making a profit." He said the company lost $17 million last year, and appears headed for a $20 million loss next year.

Could further automation reverse this trend?

"You could take away all of the labor costs and there still wouldn't be a profit because the product is being 'given away' at cost," he replied, going on to explain that a television that sells today for $300 would have to carry a price tag of $1,800 to cover the inflation alone that has occurred since 1967. The retailer hasn't lost any of its mark-up, he said, because the manufacturer is the one who has absorbed the competitive beating.

Rather than cutting cost through more automation, the executive said there will have to be more diversification and he sees a reduction in the number of manufacturers coming through mergers and takeovers. This already is occurring, he said, with three companies beginning to emerge as the leaders -- Phillips of The Netherlands, selling products under the Sylvania, Philco and Magnavox brand names: Matsushita of Japan, which markets Quasar and Panasonic, and Thomson of France, carrying the General Electric and RCA

brands. Zenith is the only American company still making and marketing televisions, he said.

The Yen Yawn

The other world factor was raised by the mayor, who the strong yen/weak dollar was "tearing up" the local plant because most of the components assembled there came from Japan and, therefore, were treated as imports. The state industrial development agency has been putting together a program to build the state economically from within, in part by helping existing producers locate new markets at home. The change in the currency rates has given impetus to the agency serving as "Matchmaker" for plants that have been relying on foreign parts.

The television/microwave oven plant and its vendor needs were to be featured at the area's first matchmaker forum in September 1987, indicating Makoto's willingness to search for cost-cutting changes. In view of the world-wide problems besetting the plant, its chief operating officer was asked if he though the facility would "still be around" in five years. "Yes," he replied, "it will be here in some form in five years, but how it will be operating or with what products I can't say."

Cultural Differences: An American Perspective

Japanese management techniques have not been used at the consumer electronics plant that is the subject of this report. "We would love to use quality circles," the chief operating officer asserted, but a judgment was made early that the labor situation was not conducive to such changes.

The Japanese, however, have been involved directly in the plant's operation since it was acquired in 1977. There is a Japanese president at the company, and more than two dozen other Japanese managers and engineers were reported to be on site in August 1977.

The Japanese families live in the community and send their children to the public schools, despite the low levels of expenditures. (Local schools spend only about 60 percent of the national average per student.) Their American school work, however, is supplemented by tapes from their home country and by Saturday morning Japanese language courses given in the large city nearby.

A Japanese company constructed the automated production lines at the plant. When the firm said "come and check out" the first one it built, three American engineers -- all veteran employees at the plant -- journeyed to Japan. This gave them a first-hand look at the over-all culture that they previously had worked with only in terms of individuals.

Two of the three engineers were interviewed extensively about differences they have encountered between Japanese and American engineering and operating methods. The third engineer touched on some differences in a separate, wide-ranging interview. Their remarks were given as matter-of-fact observations and should not be construed as criticisms of any individual.

With a laugh, one of the engineers commented that he was convinced the Japanese believe that "if you spend enough hours on a job, it'll get done. They are very dedicated," he added, "but they have a tendency not to look at the overall picture." Asked to elaborate, the other engineer said the Japanese "don't pay as much attention to very fine details. In Japan, other people pick up those details; our people don't do that." Each Japanese "concentrates on his little area" of responsibility or expertise. "It's a difference in culture. Their culture does things a different way, and it works very well for them," the Americans said.

Asked for an example, one of the Americans talked of how Japanese tested for picture tubes, looking for better quality. They selected one. In fact, they approved three tubes, but none would work with the plant's automated equipment. That's because the Japanese were concerned only with the picture and paid no attention to the fact that four small mounting brackets had to be positioned precisely at the corners of the tube for the screw-driving machines to work. The tubes "have a good picture, but it [the choice] affects the manufacturing process." the Americans said.

"Our Japanese engineers tend to forget we have this equipment," they said. But the Americans do not believe the Japanese engineers individually are at fault for the memory lapse. The Japanese engineers at the plant now are not the same ones who helped designed the automated equipment. This is because the Japanese sign contracts with the company to spend three years in America, though a few have extended their time. The Americans seem to think the company would be served better with less frequent turnover among the Japanese engineers.

Lack of stability apparently concerns the American engineers. They noted with obvious envy that Japanese production people "have technical skills," i.e., an operator has been doing the same job for years after being thoroughly trained by another operator. As noted previously, this often is not the case in the local plant where the labor contract provides that those with seniority may "bump" others with less seniority from tasks to avoid being laid off. The American engineers feel this lack of familiarity with equipment and tasks hinders productivity, especially when "in six months, we may be running a different product line.

Work -- the job -- is the top priority with Japanese men and they are accustomed to giving it 12 to 14 hours a day, the American said. The family is second. Therefore, the Japanese are puzzled when an American insists on leaving the work place at 5 p.m. because "I promised the wife and kids that we'd go out to dinner and maybe a show tonight" or a baseball game has been scheduled in which the children are to play. "It's hard for them to work with us because we have other interests [besides work]", one of the engineers said.

As could be expected, the Japanese tend to stick to themselves and form firm friendships within their own group. The Americans said they probably would, too, it they were working in a foreign country. However, the Americans said the Japanese don't question anything a close personal Japanese friend does and are given to using their friendships to get what they want, often at the expense of a company. A Japanese who is a personal friend of a higher company official will not hesitate to go around established channels to get what he wants, they said. "They're not fair," one engineer declared. Although so-called "old boy networks" exist within corporate or other segments of American society, they said Americans are less likely to use friendships as directly as the Japanese.

The Japanese have a reputation in the United States of being "great planners." But these engineers say that is a myth. "If they plan, the keep it a secret," one commented. Another said that "the Japanese operate out of their back pocket."

Revealing their frustration with the post-strike climate at the plant, one American engineer said they used to be aware of what the Japanese had in mind for the facility for the next two years. That's not the case anymore.

Another said the "everything has been on the upswing" for the Japanese as they rebuilt their economy after World War II. That is no longer the case, and the engineer said

he questioned whether they have the ability to respond to changed circumstances . "There are some gut-wrenching decisions that are going to have to be made, and I don't know that they're capable of making them," he said.

Appendix A

Sources of Information at Calsonic

Unless otherwise specifically noted, information in this report was obtained from:

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