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ABSTRACT

Although more than 1 million people in the United States are employed in the apparel manufacturing industry, the industry has been increasingly threatened by international competition, changes in consumer tastes, and demands that many domestic firms are ill-prepared to meet. The traditional apparel production system emphasized cutting costs, especially the cost of direct labor, by breaking down the production process into many separate components. In response to the increase in international competition in the late 1960s and early 1970s, apparel makers intensified this traditional strategy. However, this approach was not successful, both because of technological barriers to automation and because of changes in consumer demand for apparel that weakened some previously successful markets. As a result, some apparel makers are now trying to move to production systems that involve greater flexibility, faster production times, greater interaction with customers and suppliers, and more attention to both product and process innovation. This strategy requires a more sophisticated use of advanced microelectronic technology as well as profound changes in human resource philosophy and practice, including much more attention to the educational preparation and continuing training of the work force and a change in the orientation of management. Postsecondary textile and apparel schools are well connected to the industry and have access to information about industry needs, but community colleges are not. The industry must press for better secondary education and provide more postsecondary education, especially in technical skills. (42 references) (KC)

Technology, Skills, and Education in the Apparel Industry

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The analysis and conclusions are my own and do not necessarily reflect the policy or opinions of the Department of Education, the individuals with whom I talked or the firms and institutions that they represent.

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Executive Summary

More than one million people are employed in the apparel manufacturing industry and they represent over 6 percent of manufacturing workforce in the U.S. Starting in the late 1960s and early 1970s, however, domestic employment in this industry was increasingly threatened by international competition. In 1960, imports consumed one percent of the apparel market; by 1988, more than half of the apparel dollar was spent on foreign-produced apparel. In addition to foreign competition, the industry has also been buffeted by changes in consumer tastes and demands that many domestic firms were ill-prepared to meet.

This report assesses the roles that human resource policy in general and education and training in particular can play in the industry's response to its current challenges. To understand the human resource component, it is necessary to assess the types of skills needed for the strategies that apparel makers are trying to pursue. The report also addresses the ongoing controversy about whether modern technology has increased the required skill levels for workers or whether it has been used to reduce needed skills. The report's argument can be stated as follows:

The traditional apparel production system: The traditional production strategy in apparel emphasized cutting costs, especially the cost of direct labor, by breaking down the production process into many separate components. A critical element of this strategy was the accumulation of inventories of inputs, work in process, and finished goods that allowed each small step in the production process to be engineered in isolation. The inventories acted as buffers, preventing problems or delays in one step from spreading to other steps. This approach to production was accompanied by a human resource strategy that was aimed both at reducing the skill requirements and at reducing the direct labor required for any item. Far from seeking to enhance t' educational preparation of the workforce, this strategy was de..igned to reduce the educational and training needs of apparel workers. As a result, apparel workers had low levels of educational attainment and received little formal training once on the job.

In response to the increase in international competition in the late 1960s and early 1970s, apparel makers intensified the traditional strategy. They continued to search for ever cheaper labor, more precise engineering of the individual tasks, and opportunities to automate and to reduce the skill requirements of apparel production workers.

The emerging production system: The intensified traditional strategy was not successful in slowing the growth of imports, both because of technological barriers to automation and because of changes in the consumer demand for apparel that weakened some of the markets in which U.S. producers had been most successful. As a result, some apparel makers are now trying to move to production systems that involve greater flexibility, faster production times, greater interaction with customers and suppliers, and more attention to both product and process innovation.

This strategy requires a more sophisticated use of advanced micro-electronic technology as well as profound changes in human resource philosophy and practice, including much more attention to the educational preparation and continuing training of the workforce. The strategy requires a fundamental change in the orientation of top management. It puts new demands particularly on middle-level personnel such as mechanics and supervisors. But the job of the sewing machine operator has changed as well. Competency at a larger number of tasks, broader skills, a stronger conceptual understanding of work processes and business operations, increased ability to interact with other employees, and the ability to work in a more rapidly changing and less well-defined environment are all increasingly important for new human resource strategy.

The system of education for the apparel industry: How ready is the system of training and education for the apparel industry to prepare the workforce for those new demands? The post-secondary textile and apparel schools are well connected to the industry and at least have good access to information about industry needs. Although there is some disagreement about how best to prepare apparel managers and engineers for the emerging environment, at least an institutional framework is in place that can address these needs.

The role of general community colleges in preparing managers and technicians for the industry is much weak r. These schools lack strong contacts with the industry and do not tend to attract students who start out with an interest in apparel. For example, apparel makers increasingly seek graduates of electrical engineering associate programs to fill mechanic and technician positions. But it is difficult to attract these graduates to a traditional manufacturing industry such as apparel. Especially in the south, students in these programs often go to community colleges precisely to avoid a job in the mills. As a result, training for the middle level occupations--those needing a high school education with some additional technical training--is problematic. The weakness seems to result from a lack of appreciation of the importance of these jobs on the part of employers, a lack of interest on the part of students, and poor quality and insufficient capacity in the education system.

The preparation for entry-level occupations must rely primarily on the outside educational system. The potential problem here is that so many of the industry's lower level workers have weak basic skills. In the past, industry managers have seen low educational levels as an asset to the apparel labor force--they believed that apparel workers did not need a secondary school education, and that high school degrees would just increase their expectations. But good basic skills are now more important and to the extent that apparel firms face a more rapidly changing environment, they need workers at all levels who are adaptable. And solid general education helps individuals adjust to change.

Finally, much of the educational challenge facing the industry in the future will involve training and retraining adult workers and current employees. Continuing changes in technology, products, market characteristics, firm organization, and production processes will require more frequent retraining and updating of knowledge. Informal training has always been an integral part of workplace education, but informal training is primarily useful for passing on knowledge from one group of employees to another. More explicit and organized means are needed for diffusing more rapidly changing skills. Moreover, if experienced lower level employees continue to be the primary source of mechanics and supervisors, retraining and upgrading will be the key to the effectiveness of these increasingly important and demanding positions.

A reform strategy: An educational reform strategy for the industry would include the following components: Management training needs to be oriented to be more in tune with the demands of more flexible production systems, with an emphasis on the need for organizational innovation within the firm and for more sophisticated relationships among firms within the industry and in textile and retail industries. Post-secondary training for technicians and supervisors is particularly lacking and urgently needs to be strengthened. Entry level preparation is hampered by weak basic skills and deficient secondary school systems. Firms must work with local public schools to improve that system, but they may also need to provide basic skills training to their own workforce either on their own or with financial assistance from the public sector, trade unions, or employer associations. The industry needs to put particular emphasis on upgrading and on-the-job training. It is primarily through the education and retraining of experienced workers that firms can both meet the rising skill needs of emerging work processes and continue to play an important social role in providing employment for workers with low levels of educational attainment.

The research is based on information gathered from field visits to 17 apparel manufacturing plants owned by 13 different firms. The smallest plant had one employee and the largest had 2000. The largest firm in the sample had 15,000 workers. The sample was chosen to include plants making a variety of products and using modern as well as older equipment. I also included plants that were using sewing modules and two that were using unit production systems. The plants were located in New York, Pennsylvania, Tennessee, Georgia, Alabama, and Wisconsin. Information was also gathered from visits to six schools and educational centers that provide training and instruction for the garment industry, and from telephone interviews with five additional schools.

Chapter 1

Introduction

More than one million people are employed in the apparel manufacturing industry. It accounts for over 6 percent of manufacturing employment in the U.S. (USDOL 1989). However, the importance of the industry cannot be understood through its employment totals alone. It has provided a first job in the U.S. for millions of immigrants and a first job in the industrial sector for millions of rural residents displaced from U.S. farms. Apparel is still a major employer in many cities with growing immigrant populations. It remains the largest manufacturing industry in New York City and apparel employment has actually grown in Los Angeles and southern California during the late 1980s. Garment factories continue to be an important source of employment in the south, especially outside of the major metropolitan areas. The apparel manufacturing industry also generates demand for the textile and fiber industries, which are also large sources of employment in the U.S., and is an essential component of the apparel design and merchandising centers that play such an important role in New York and increasingly in other cities such as Los Angeles.

Starting in the late 1960s and early 1970s, however, domestic employment in this industry was increasingly threatened by international competition. In 1960, imports consumed one percent of the apparel market; by 1988, more than half of the apparel dollar was spent on foreign produced apparel (AAMA

1988a:Tables 23 and 24). In addition to foreign competition, the industry has also been buffeted by changes in consumer tastes and demands that it was ill-prepared to meet.

Apparel manufacturers and their representatives and advisors still look to various types of legal import barriers to protect domestic production, but other strategies are also being used. Although production technologies had changed little in decades, in the last 15 years some garment makers have put more emphasis on automation in an attempt to reduce labor costs, and even more recently some have experimented with combining modern technology with organizational innovations.

This report assesses the role that human resource policy in general and education and training in particular can play in the industry's response to its current challenges. To understand the human resource components, it is necessary to assess the types of skills needed for the strategies that apparel makers are trying to pursue. The report's argument can be stated as follows:

The traditional production strategy in apparel emphasized cutting costs, especially the cost of direct labor, by breaking down the production process into many separate components. A critical element of this strategy was the accumulation of inventories of inputs, work in process, and finished goods that allowed each small step in the production process to be engineered in isolation. This was accompanied by a human resource strategy that was aimed both at reducing the skill requirements and at reducing the direct labor required for any item. Far from seeking to enhance the educational preparation of the workforce, this strategy was designed to reduce the educational and training needs of apparel workers. As a result, apparel workers had low levels of educational attainment and received little formal training once on the job.

The industry's response to the increase in international competition in the late 1960s and early 1970s was to intensify its traditional strategy. Apparel makers continued to search for ever cheaper labor, more precise engineering of the tasks themselves, and opportunities to automate and to reduce the skill requirements of apparel production workers.

This strategy was not successful in slowing the growth of imports, both because of technological barriers to automation and because of changes in the consumer demand for apparel that weakened some of the markets in which U.S. producers had been most successful. As a result, some apparel makers are now trying to move to production systems that involve greater flexibility, faster production times, greater interaction with customers and suppliers, and more attention to both product and process innovation. This approach requires a more sophisticated use of advanced micro-electronic technology as well as profound changes in human resource philosophy and practice, including much more attention to the educational preparation and continuing training of the workforce. This strategy therefore represents a fundamental departure from traditional management practices, particularly human resource management practices.

Technology and Skills in the Modern U.S. Economy

The shifts in the relationship between technology, skills, and human resources in the apparel industry over the last two decades reflect similar developments in many industries and, indeed, in the economy as a whole in an era of much more intensive competition and profound changes in markets and consumer demand for goods and services. Those developments can help provide a broader context for this study of one industry, but the study can also offer insights into the more general trends in skill requirements and the controversies.

During the post World War II era, rising educational levels and advances in automation suggested that the evolving economy required ever increasing skills. In the early 1970s, some analysts attacked the notion that skill requirements were rising, arguing instead that production level jobs were being "deskilled." Not only did these jobs require fewer skills, but production was set up in such a way as to remove control of work from the shop or office floor, vesting all authority with managers.[1] Indeed the deskilling argument seemed consistent with developments in the apparel industry, and as has been suggested, the increase in international competition intensified the industry's attempts to find technology that would simplify and

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[1]The classic statement of this argument was by Braverman (1974). This controversy is discussed in more detail in Bailey (1989).

deskill the lower level jobs in the industry.

But by the mid-1980s, the deskilling hypothesis began to lose its appeal as weaknesses in the educational system were increasingly blamed for the country's apparently faltering position in international markets. These developments were also accompanied by a more sophisticated attack on the deskilling notion. In the 1950s and 1960s, economists had argued that modern technology itself was creating a need for higher level skills and more education. But it was easy to find examples in which the most modern micro-electronic equipment made some tasks easier. In the 1980s, a new generation of industry analysts shifted the focus away from technology and argued that changes in consumer tastes and demands required a production process that not only cut costs but was also more flexible and responsive. Although the human resource, training, and educational implications of this have not so far been well-worked out, much of the recent research does suggest that more flexible production processes in both manufacturing and services do require more educated and skilled workers and a new approach to managing the firm's workforce.[2] It appears that despite a strong tradition of

[2]Piore and Sabel (1984) made one of the first comprehensive statements about the need for increasing flexibility. Some of the particulars of their argument have been challenged, but the notion that changes in consumer demand have broken up mass markets, thus favoring firms or groups of firms that can produce a wide variety of goods and services in small quantities rather than immense batches of identical items, and that can react flexibly to market shifts, is widely accepted. Hayes, Wheelwright, and Clark (1988) present a more recent statement of the need for flexible manufacturing and suggest how it can be achieved. But neither of these sets of authors focus on the

attempts to deskill the workforce, this trend toward flexibility and increasing skill requirements is now beginning in the apparel industry.

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This report first describes the traditional production system and its accompanying human resource strategy. I then discuss the industry's response to intensified competition--the attempts to preserve and enhance the traditional production and human resource systems through further wage reduction and automation. The following section looks at the forces that have undermined that traditional system even when augmented by automation. Next I describe the emerging flexible manufacturing system in the industry and assess the extent to which it has spread. The next sections discuss the educational implications of the new system, describe the current educational system in the industry and assess the extent to which that system meets the industry's current needs.

The research is based on information gathered from field visits to 17 apparel manufacturing plants owned by 13 different firms. The smallest plant had one employee and the largest had 2000. The largest firm in the sample had 15,000 workers. The sample was chosen to include plants making a variety of products and using modern as well as older equipment. I also included some plants that were using sewing modules and unit production

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skill and training implications.

systems. The plants were located in New York, Pennsylvania, Tennessee, Georgia, Alabama, and Wisconsin. Information was also gathered from visits to six schools and educational centers that provide training and instruction for the garment industry, and from telephone interviews with five additional schools.[3]

[3]Some of these interviews were carried out during a project I conducted with Roger Waldinger. See (Bailey and Waldinger 1987).

Chapter 2

The Traditional Production System

Until the last twenty years, the apparel production process had changed little since the turn of the century. This chapter first describes the traditional production system and discusses its strengths and weaknesses. I then describe the associated human resource strategy.

A Fragmented System

Production workers hold a much higher share of apparel employment than they do in other manufacturing industries. Of the 1.1 million workers employed in the industry in 1988, 84 percent were production and non-supervisory workers. Only about 68 percent of all manufacturing workers were non-supervisory production workers. Moreover, the apparel workforce is dominated by sewing machine operators. About 70 percent of all workers employed in the industry are classified as operators. Craft and repair workers and sales workers each account for about 10 percent of the workforce.[4]

The fundamental approach to improving production in the apparel industry has been to focus on cost cutting, especially direct labor cost. This strategy pursued two fundamental goals--the preservation of low wage levels and the reduction of the

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[4]The employment data are from U.S. Department of Labor 1989. The occupational data are calculated using data from the public use sample of the March 1988 Current Population Survey.

direct labor content of the production process. The basic approach to reducing labor content was to isolate each stage of the production process, thus allowing managers and engineers to examine, engineer, and rationalize each step separately. As a recent report by the American Apparel Manufacturers Association (AAMA) pointed out, "Manufacturing executives in the sewn products industry have traditionally spent their careers maximizing the output of individual operators" (AAMA 1988b:11). This fragmented production focus was reflected in the inventory practices, the organization of plants, and the industry structure. I will consider each of these below.

A fundamental means for preserving this fragmentation was the accumulation of in-process inventories. The garment industry has taken this principle to an extreme. Through the use of the "bundle" system, which is still employed by the overwhelming majority of apparel makers, substantial amounts of inventory separate each individual operator. In this system, cut garment parts are tied into "bundles" of about 30 pieces. The operator takes a bundle and performs one, usually very small, task such as sewing a hem, attaching a pocket, or joining a front panel of a shirt to the back. When the operator has performed her task on the 30 pieces in the bundle, she processes a work ticket to keep track of her work, reties the bundle, and begins work on another. In the bundle-system plants that I visited, operators had between 1.5 and 8 hours of work waiting for them. Although the work of many operators goes into the production of each garment, each operator can be paid according to her actual production--piece rates. In effect, the bundle system, linked to piece rates, makes each worker an independent contractor.

Although the bundle system promotes individual productivity, it requires a tremendous amount of in-process inventory. A men's shirt, for example, requires between 40 and 60 operations. Each operator usually has two bundles waiting at her station for processing; thus at any given time, there are thousands of garment pieces sitting around the factory floor in bundles. Most garment producers using the bundle system do not have a precise measure of the time that it takes for a particular piece of cloth to move through the factory. According to the AAMA, there are often between 15 and 20 days of work-in-progress in plants producing garments requiring no more than 20 standard minutes of labor, although in well-managed bundle systems, there can be as little as four of five days of work-in-progress (AAMA 1988b:12).

While the bundle system isolates each worker, the typical organization of garment plants isolates each step within the overall production process. Factories are set up so that each step in the production process is carried out in large "functional" departments. For example, traditional shirt plants, even those with some semi-automated equipment, are divided into departments that carry out particular functions. Thus for example, pocket setting or button hole machines or operators sewing a given seam are all grouped together, and all orders go to a centralized packaging department. Supervisors have authority over one or perhaps a small number of functions, and mechanics working in these plants are only exposed to the machines needed for the department's functions. Orders move through one at a time and in-process inventories are often accumulated between departments. Like all inventory accumulations, this guarantees the continuous use of the equipment in each department, but slows down the throughput time. Furthermore, large orders with long lead times are mixed in with short rush orders, and it is extremely difficult to vary the speed of the process without making awkward special arrangements.

The vertical structure of the industry is also highly fragmented. Although apparel makers depend on textile producers for inputs and retailers or wholesalers for their sales, there is frequently little communication and interaction among firms at the different levels. Interfirm relationships are at arms length and mediated by the market, and intermediaries often separate the actual producers from each other or from the retailers. Thus textile makers sell their goods through converters or wholesalers, rather than directly to the apparel makers. It is often in the interest of such middle men to minimize the flow of information and communication between their suppliers and their customers. In general, it is rare that managers of garment firms have a sophisticated understanding of the economics and operations of either the textile or retail firms with which they work.[5]

Even within many sectors of the garment industry the "manufacturing/contractor" system further fragments the production process. In garment centers such as New York, the apparel is designed and marketed by "manufacturers" or "jobbers." This system is most common in women's wear and other more variable and style-sensitive sectors. Some manufacturers actually manufacture apparel, but for the most part they use "contractors" to produce the goods. (Often the manufacturers cut the fabric and distribute the pieces to the contractors.) The contractors are often small firms owned by immigrants and employing a predominantly immigrant workforce. They also use technologies that have changed little in decades (indeed until recently there were few innovations that they could use).[6] But whatever the production techniques they use, the manufacturers are not involved in the day-to-day process of making garments.

Thus the isolation and fragmentation in the market extends from the level of the individual worker to the industry's vertical structure. The bundle system isolates the individual workers, the functional departmental organization isolates the different processes within the plant, and the fragmented vertical structure and arms-length relationships among firms isolate the

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[5]For a useful discussion of antagonistic relations up and down the supply chain, see MIT 1988:85-86.

[6]For a detailed discussion of the contractor system and the immigrant role in that system see Waldinger 1986:chap. 3.

stages of production within the supply chain.

Strengths and Weaknesses of The Traditional System

This system has some significant strengths. First, by fragmenting the production process it allows engineers to focus on maximizing productivity at each step. And the in-process inventories protect each task from problems occurring elsewhere in the production chain. However, this high productivity is bought at a price. The accumulation of inventories adds months to the production cycle, the maximization of the productivity of each individual worker may not necessarily result in the best overall productivity level, and the minute engineering of each small step makes it more difficult to change styles. Thus the system is inflexible and sluggish in responding to market changes. This rigidity was captured in a recent statement by the AAMA: "A work shirt plant made work shirts. It could not change to another product without literally tearing itself apart. Merely changing over from short sleeves to long sleeves each year was a dreaded, disruptive event accompanied by great anguish and turmoil" (AAMA 1988b:11).

This system is most productive for standardized apparel that rarely change and that is produced in large quantities. Indeed, earlier products tended not to change. The success of much of the American apparel industry, like most domestic manufacturing industries, was based on the production of low cost, mass produced goods for a huge domestic market that was large enough to absorb enormous quantities of standardized goods and in which styles changed very slowly.[7]

To be sure, the industry comprises several distinct and disparate segments and this description fits best for those segments that produce basic or standardized commodities such as jeans and men's trousers, underwear, sweatshirts, sox and hose, and most men's shirts. The production of basics involves the manufacturing of thousands of dozens of identical garments for which styles rarely change. By the end of the 1970s, the pattern for Levi's best selling 501 jeans had received only minor modifications since it was first introduced in the early 1880s (Brooks 1979). The design of men's white shirts was hardly altered for decades and it still takes a trained eye to spot changes in the design of standard tee shirts and men's underwear.

[7]This argument is developed for the economy as a whole in Piore and Sabel 1984. For a more focussed discussion of apparel see OTA 1987.

Women's wear producers and some firms in other sectors have always had to adjust to the biannual style changes.[8] Nevertheless, even in these segments there were long lead times of many months.[9] Moreover, even for women's wear, contractors often produced tens of thousands of each item. A women's sleepwear producer in Pennsylvania stated that ten years ago, 90 percent of his orders were large enough to be sent by truck and only 10 percent were small enough to be sent through United Parcel Service. (Now 99 percent of his orders are sent through UPS.) And a Liz Claiborne contractor in New York City still produces typical orders of 20 or 30 thousand pieces.

Nevertheless, despite these large order sizes, the women's wear makers are more flexible than the basics producers. Women's wear and other more variable garments are usually produced using the contractor system which did allow for more flexibility.

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[8]The published data do not allow a precise measure of the basics and the style sensitive sectors. In 1982, shipments by makers of men's wear, children's wear, and underwear, which tend to be less affected by style change, totaled about $22 billion. Shipments totaled about $21 billion for the more style-oriented sectors that made women's wear, furs, hats, and miscellaneous apparel and accessories (U.S. Bureau of the Census 1982). But this is a very rough estimate and there is wide variation within each of these subsectors. Based on interviews with industry marketing specialists, the Office of Technology Assessment estimated in 1987 that about 35 percent of the market was accounted for by "fashion" items that had a 10 week life, 35 percent by "seasonal" items with a 20 week life, and 20 percent by "basic" items that are sold throughout the year (OTA 1987:16).

[9]A sweater producer in New York City pointed out, for example, that traditionally he started working on the September deliveries in February.

Indeed much of the apparel factory employment that is left in New York is based on the production of short runs of styled goods and fill-in orders. This flexibility depends on an immigrant contractor system that can quickly expand and contract the labor force by drawing on immigrant social networks.[10] But as a result, employment in this sector must be low-paid and unstable and modern technology is almost completely absent.

The Traditional Human Resource Strategy

The traditional production system was matched by a particular human resource management strategy. The apparel industry historically based its recruitment and employment practices on the search for new sources of labor, such as recent immigrants or southern rural populations, that had not previously been fully integrated into the mainstream economy and labor market. The movement of the apparel industry from New York and the northeast to the south was based on an explicit search for lower labor costs.

The availability of these labor supplies has allowed apparel manufacturers to pay wages that have steadily fallen for four decades relative to the average manufacturing wage. In 1950, full-time apparel workers earned three-fourths as much as the typical manufacturing worker, but by 1985, they earned just over half as much. Furthermore, more than three-fourths of that drop

[10]For a more complete discussion of this point, see Waldinger 1986:chap. 4.

took place before the dramatic acceleration of imports during the middle of the 1970s (AAMA 1988a:Table 12).

For generations, apparel production in New York has drawn on pools of immigrant labor whose lack of skills, capital, and English speaking ability restricted their opportunities in other industries. Moreover, the low wages paid by the industry at least compared favorably to the alternative employment opportunities in their home countries. But immigrants engaged in this type of activity almost always wanted their children to find work in more pleasant and remunerative activities. Thus the labor supply in these cities depended on the constant arrival of new recruits from abroad. (In the case of European immigrants this system had an additional benefit in that it brought to the industry tailors, seamstresses, and other skilled workers who had been trained abroad.)

In the southeast, immigrants have never been a significant labor supply, but there the industry tapped a rural labor force that had previously been engaged in agriculture. Although urbanization has spread rapidly in the south, traditional non-durable manufacturing activities (predominantly textiles and apparel) remain concentrated in non-metropolitan areas (Rosenfeld 1985).

Although the industry has relied on these newcomer labor supplies, garment operative jobs cannot be accurately classified as unskilled. The simplest sewing task in any of the factories studied for this report required between 12 and 15 weeks to reach normal proficiency.[11] Nevertheless, although the jobs required some experience, the nature of the production process kept the skill requirements down. Once experience was acquired on a limited number of tasks, little change or retraining was required. Long runs of standard goods allowed the simplification of labor processes in which workers could be employed in standard and predictable tasks. Even the relatively advanced skills could be learned on the job by high-school dropouts. Sewing machine technology appeared intricate, but the machines operated on basic electro-mechanical principles. Moreover, there was little change for many years, so illiterate or semi-literate mechanics could pick up the necessary skills by trial and error or by assisting more experienced fixers. Thus almost all of the jobs up through first level supervisors were filled by workers who had entered as unskilled workers and who had learned the necessary skills informally on the job. Formal education or training either as a prerequisite for entry level employment or within the firm was not important. Workers learned to do their tasks by observation and trial and error and since their tasks rarely changed, this concrete or experience-based knowledge was adequate. Understanding what they were doing at a conceptual level was not

[11]The large majority of sewing and stitching jobs listed by New York City garment employers with the New York State Job Service require at least one year of experience. In a survey of 41 apparel employers in New York City conducted in 1984, 24 said that the majority of the workers that they hired were skilled and another 13 said that most of the workers that they hired were semi-skilled. See Bailey and Waldinger 1987:2. These unpublished survey results were provided by Roger Waldinger.

necessary. In this context, education was seen as unnecessary and a possible encouragement to higher wage demands.

Since the overriding goal of the plant organization was to fragment the production so that each step could be rationalized separately, the coordination of the various steps fell completely to management. This led to the development of centralized hierarchies in which there was relatively little scope for individual initiative or responsibility on the part of the production workers. Education was also a possible threat to this type of autocratic personnel policy.

Therefore, the traditional human resource system in these industries was characterized by a preponderance of unskilled and semi-skilled workers engaged in well specified tasks, reliance on informal on-the-job training, low or non-existent educational prerequisites for entry level jobs, and a strong hierarchical and authoritarian management style with little scope for responsibility and initiative on the part of production workers. In the next section we begin to look at how this system has been affected by the changes in technology and markets that have taken place over the last twenty years.

Chapter 3

Automation and Deskilling--The First Stage Response to Imports

In 1950, there were about 1.2 million employees in the apparel industry. They accounted for 8 percent of the entire manufacturing workforce. For many years--from the mid-1960s through about 1979--apparel employment was stable at just over 1.3 million workers. It then started a steady decade-long decline, losing about 15 percent of its jobs by 1988. But the moderate decline in apparel employment hides a much sharper loss of market share for the domestic industry. The trade deficit in apparel increased from $1.2 million (1983 dollars) in 1967 to $15.8 million in 1987. In that year, just about one half of total U.S. expenditure on apparel went to foreign-made garments.[12]

Apparel is vulnerable to import competition because it has moderate skill requirements and easily-copied and cheap technology. Although some machines used in apparel manufacturing can cost hundreds of thousands of dollars, even advanced sewing machines cost less than $5,000 and used machines can be bought for much less.[13] This leaves the industry open to direct competition from countries with much lower hourly compensation

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[12]The data in this paragraph are from the AAMA 1988a:4.

[13]Self loading sewing machines can cost much more, but the purpose of the self-loading features is to cut labor costs. Since labor is so cheap in many of the countries that compete with the U.S. apparel industry, these features are not necessary. See the discussion of automated sewing in Chapter 4.

costs.

Indeed wages in many countries that compete for apparel markets are only a fraction of U.S. wages. For example, in 1985, hourly compensation for apparel workers in Hong Kong was about one quarter of the compensation in the United States (using 1985 exchange rates). And compensation in dollar terms in Korea, Singapore, and Taiwan were all below the Hong Kong rates.[14] Hourly earnings (including fringes) in the Caribbean in 1988 ranged from $.55 an hour in the Dominican Republic to $2.10 an hour in Barbados (Gaetan 1988).

Wage Cuts

As imports accelerated in the 1970s, the industry's first response was to intensify its traditional production and human resource policy. Employers sought to further reduce wage levels and they looked to automation to reduce the direct labor content of the their products.

The accompanying chart displays the ratio between average manufacturing apparel earnings. In 1950, apparel earnings were about 77 percent of average manufacturing earnings. The ratio fell sharply during the early 1950s but stabilized until the end of the 1960s. It once again plummeted during the 1970s. By 1987, apparel earnings stood at only 54 percent of manufacturing earnings. The second chart shows the average weekly earnings for

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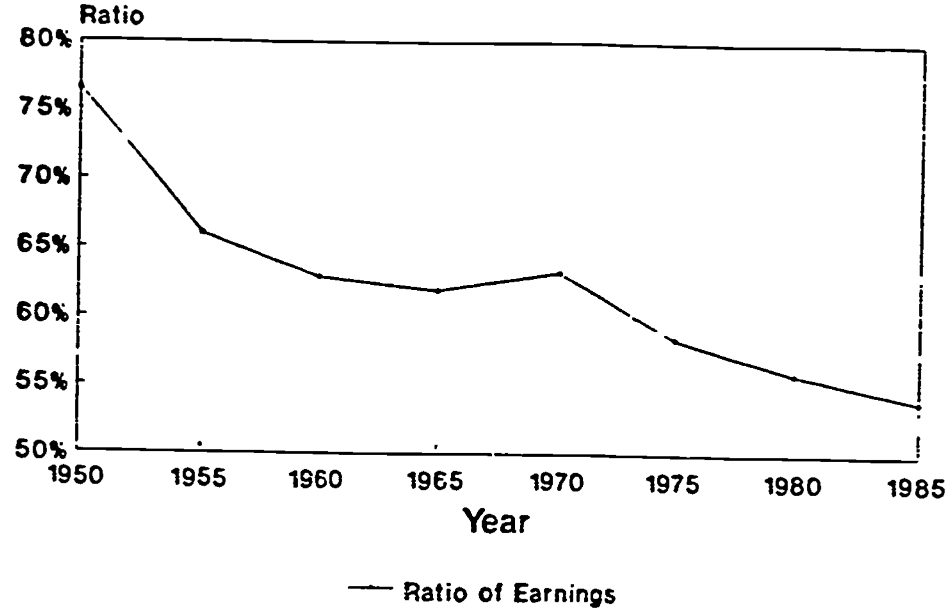
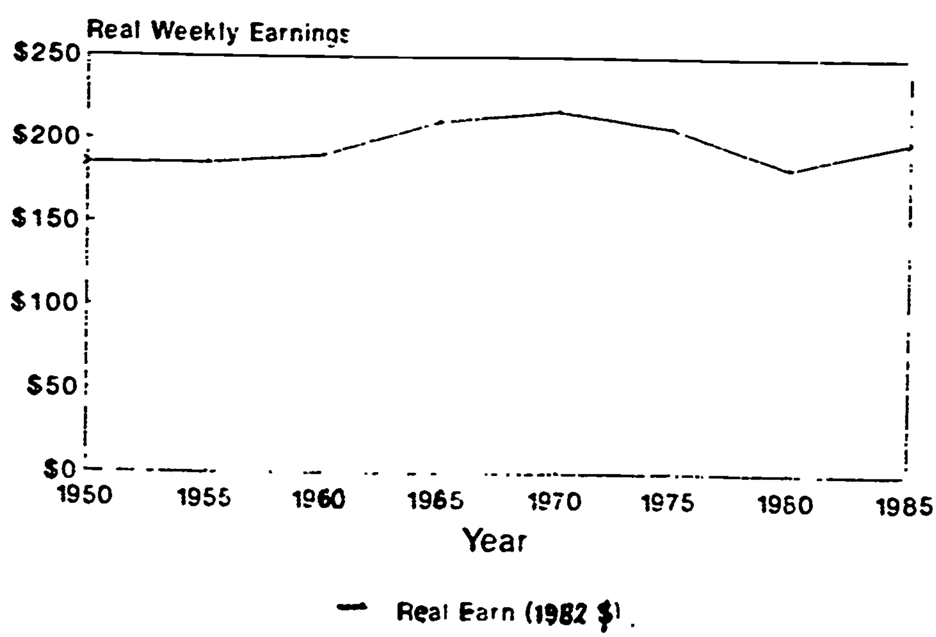
[14] Unpublished data from the U.S. Bureau of Labor Statistics.

Ratio of Apparel to Manu. Earnings (1950-1985)



Source: AAMA, Focus 1988, 1988, table 12

Real Weekly Earnings of Apparel Workers (In 1982 dollars)



Source AAMA, Focus 1988, 1988, table 12.

the industry and for the manufacturing sector (in 1983 dollars) from 1950 to 1985. After adjusting for inflation, apparel workers earned no more in 1985 than they did in the early 1960s and less than $10 a week more than they did in 1950. Obviously falling wages have not been enough to stem the tide of imports.

Automation was another focus of the anti-import strategy.[15] But the drive to automation was very much a part of the traditional human resource strategy--the goal was to eliminate labor and reduce the skill demands on the labor that could not be eliminated. Many garment manufacturers see the technology as a means to relieve themselves of the burden of expensive labor. A recent article in Bobbin, a leading trade publication, stated the position succinctly.

> Our main hope for the return of production of basic apparel items to the U.S. mainland is automation of the production process. Only with the **labor element** essentially eliminated through robotic automation can the advantages of the emerging countries be overcome by the U.S. manufacturer [emphasis added] (Riley 1987:76).

Of course, no one with even a superficial knowledge of the industry believes that the "labor element" will be eliminated from apparel manufacturing within the next twenty years. Short of the "lights out" factory, the industry is looking to technologically based "deskilling" to give it a boost in the

[15]For a description of the state of apparel production technology about 1980 see Hoffman and Rush 1988:II. For a description of developments in sewing technology through 1985 and 1986 see OTA 1987 and Riley 1987.

competition. Thus the second part of the Bobbin discussion of apparel technology stated:

> Savings in labor costs through the deskilling of sewing operations is becoming a key factor in the apparel manufacturing process, as the mechanization of sewing moves forward and automated equipment continues to be regularly introduced (Shepherd 1987:93).

Indeed, similar statements can be found in almost every discussion of apparel technology in the trade press.

The conviction that a high school education is not important, that it will increase the dissatisfaction of the workforce, and that technology can be used to keep up production standards without increasing training or education (or even with an increasingly less educated workforce) is still strong in the industry. One men's wear maker in New York stated: "We have an engineering staff trying to take the labor content out of manufacturing, machines don't get sick and don't need vacations." Many employers are perhaps less open and direct, but this statement does reflect a broad sentiment in the industry. Another employer stated that he preferred operators who were not high school graduates. He said that his best workers were the older women who did not have high school degrees and who were all from surrounding rural areas. They demonstrated loyalty and satisfaction in their apparel jobs that he did not expect to find in high school graduates.

For other managers, the use of technology to deskill jobs was considered a necessity dictated by the current labor market conditions. In response to a question about educational prerequisites for hiring, one manager in the south said that he would prefer to have a more educated workforce, but "I can't even hire a high school graduate, say nothing of requiring a degree for all my employees." His plant was not particularly automated, but he was making use of attachments to individual sewing machines such as back tackers, thread trimmers and programmable devices to control the stitch pattern, and he believed that these features allowed him to get by with a workforce with no more than minimal literacy and numeracy.

The Potential for Automation

How successful was the industry in producing technology that could eliminate and deskill labor? In order to understand how new technology has affected the skill needs, it is first necessary to have some understanding of the technology itself. Garment production can be separated into five processes--1) design and sample making, 2) the preparation of the pattern, 3) cutting, 4) preparation of the parts, and 5) assembly. Major advances have been made in pattern making and cutting.

Design and Sample Making: This is still primarily an artistic endeavor in which the designer produces sketches which are turned into sample garments by skilled tailors and sewing machine operators. Once sample garments are made, in most cases, an initial pattern is prepared by hand. Software is slowly being developed that can aid the designer's job and may in the future replace sample makers, but skilled workers are still needed for these tasks.

Preparation of the pattern for cutting: The greatest level of automation has been achieved in the stage of the garment production process that follows the preparation of the initial pattern. Two steps are necessary. One, called **grading**, adjusts the size of the patterns to produce garments of different sizes. The other, called **marker making**, involves positioning the patterns for each piece in such a way that they can be cut from a piece of cloth of a particular width and length. At this point, it is possible to produce graded markers automatically from the initial pattern (a variety of technologies can be used to make the pattern computer readable). The marker can be generated automatically or an operator can assist the process by positioning on a screen the images of the pieces on an image of the cloth. Once the marker is set on the screen, the actual marker that is laid out on the fabric can be printed automatically. The systems themselves cost about $300,000, but they can reduce direct labor in the operation by 50 percent and typically cut 2 weeks off the production time.

None of the cut-and-sew companies I visited were still using manual markers. The smaller contractors who did not have their own system either had computer-generated markers delivered by the manufacturer or contracted with another firm to produce their markers. One small firm that had a system did this contracting work for other firms. Three multi-plant firms had centralized marker making (and cutting) facilities.

Cutting: Most cutting is probably still done by workers using hand-held electrically-powered reciprocating or circular knives. The plies of fabric are spread on the cutting surface and the marker is laid on top. The cutter then follows the pattern imprinted on the marker.

In the late 1960s, the Gerber Company developed a computerized cutter based on numerical control principles that is guided by the markers stored in the computer's memory. They can cut over 250 plies at a speed of up to 200 inches a minute. These modern machines can therefore cut parts for 200 dozen shirts or 2,400 pairs of pants in an hour, three times the typical output of manual cutting using an electric knife. Perhaps the most ingenious component of the Gerber Cutter was the suction system used to secure the fabric to the table while it was being cut--a function previously performed by the hand of the skilled cutter. The patent on the suction system rather than on the cutter itself is what has given Gerber its virtual monopoly of computerized cutting. Spreading, the process of unrolling the fabric from its roll onto the cutting surface, can now also be done automatically.

Until recently, the Gerber Cutter cost about $300,000. It reduces direct labor by between 25 to 40 percent. Now that Gerber's patent on the suction system has expired, the prices of computerized cutters are falling. Therefore, although only four of the 13 firms I studied used Gerber cutters, the use of computerized cutting will undoubtedly continue to spread.

Parts Preparation: Once the pieces of a garment are cut, there are several operations that must be carried out before those pieces can be joined together to form the finished garment. For those operations that can be done in two dimensions--with the fabric laid out flat--there have already been important advances in automation. For example, working in two dimensions, shirt cuffs and collars can be prepared, the hems can be sewn, the shirt pockets can be set, buttons can be attached, and the button holes can be cut and sewn. Large factories producing standardized products have had semi-automated machinery to perform these tasks for more than a decade. The operator's job involved loading the machine which would then go through a set cycle. In those functions in which it could be used, the semi-automated equipment used in parts preparation did result in some substantial reductions in the time required for each operation. The time necessary to attach belt loops on jeans was cut in half and to make button holes on men's suits was cut by 75 percent. A good manual pocket setter with six months of training could set 30 dozen pockets in eight hours (Hoffman and Rush 1988). An automated setter in which the operator is essentially a machine loader can easily set 200 dozen in eight hours. Advances have also been made in material handling so that machines can now pick one ply of cloth from a pile of fabric. In these cases, the operator's job primarily involves positioning a stack of fabric and collecting the pile of finished pieces.

At this point, the level of automation is limited by the lack of links between the tasks in parts preparation. Although each task is more or less automated, it is still necessary to have an operator load and unload each machine and move material from machine to machine.

Assembly: Technological advances in the assembly of the garment in three dimensions have been much more limited. In the early 1980s, a group of government, industry, and union representatives formed a partnership to develop apparel technology to strengthen the domestic industry. This was called the Tailored Clothing Technology Corporation--$(TC)^2$ (the name was later changed to Textile/Clothing Technology Corporation). In hopes of a dramatic and quick success, the promoters of the project promised to automate one of the most difficult processes in apparel manufacturing--setting the sleeve into the body of he garment. After almost a decade, this aspect of $(TC)^2$ has been a disappointment. An equally ambitious sewing automation program in Japan has also fallen short of its goals.[16]

Apparel must still be assembled by individual operators guiding the material through individual sewing machines. Truly automated assembly is years away. Nevertheless, there has been important progress toward more modest goals such as the development of programmable stitch control and devices to

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[16]For a good discussion of the Japanese program see MIT 1988. For an account of the $(TC)^2$, see Kaciz 1989.

automate thread trimming and tacking.[17]

Thus there have been some successes in the automation of apparel production. Contrary to popular conception, the industry has been reasonably successful in increasing productivity. Over the last ten years, labor productivity in apparel has grown at an annual rate of about 3 percent which is slightly better than the 2.7 percent annual rate of increase in the manufacturing sector as a whole (U.S. Department of Commerce 1987 and 1988:Tables 6.2 and 6.7A). Manual marker making is now rare. The falling cost of computerized cutters will also make it much more efficient for smaller apparel makers to shift away from manual cutting. There have also been important advances in parts preparation, although this equipment remains expensive and it is primarily used by the largest firms. Automated assembly is a long way off. In any case, almost all of the modernization has been carried out by the large basic-goods producers who could exploit economies of scale and indeed the basic-goods factories.

Skills and Education

In the areas that were automated, the skill requirements for some jobs did fall. For example, the skill levels of grader and marker making occupations have been reduced. Previously marker makers were skilled draftsmen. Now the skills needed to operate

[17]Previously, some operators were entirely engaged in trimming the thread ends left after each sewing operation was complete. Now sewing machines have devices that do that automatically.

the computerized marker makers are easier to learn. Manual marker makers can usually be trained to operate the computerized systems in about 6 weeks. But in one company that had recently installed a computerized marker maker, the management had simply trained one of the clerical workers to operate the system.

The skills required for both cutting and spreading have also been reduced, although the jobs of maintaining and repairing the computerized equipment is much more demanding than previous repair or maintenance jobs in the cutting departments. A survey conducted in 1981 by Kurt Hoffman and Howard Rush suggests that introduction of automatic cutting equipment can reduce training time for cutters by up to 90 percent (Hoffman and Rush 1988:94). Traditionally, the spreaders were the assistants to the cutters. Getting some experience as a spreader was often a path through which workers learned the skills needed to be a cutter, which was one of the highest paid garment occupations. Computer controlled spreading machines have now assumed many of the spreaders' tasks. For example, the automatic spreaders simplify the task of lining up the edges of each ply to minimize the waste of fabric.

Automation in parts preparation has simplified many sewing tasks. For some procedures, operators no longer guide material under the sewing head. Pocket setting was one of the more skilled sewing tasks, but the difficult aspects are now done by the machine. Data from the Hoffman and Rush survey suggest that training times for collar attaching can be cut by 60 percent, for setting hip pockets in trousers by 40 percent, for making button holes and attaching the buttons by 30 percent, for setting front pockets in jeans by 70 percent, and for decorative embroidery stitching by 90 percent. My own study of two advanced shirt plants suggest less dramatic reductions in training time. Ten years ago, parts assembly workers reached normal efficiency in 16 to 18 weeks; now that period has dropped to 10 to 14 weeks.

As I pointed out earlier, automation in garment assembly is much less advanced than in parts preparation. Skills in the assembly area have also been less affected by technology. For example, in a shirt plant assembly workers still take 26 to 33 weeks to reach normal efficiency. Advances in programmability of sewing cycles and the positioning of the sewing head have perhaps simplified the job of some operators doing assembly operations, but do not seem to have affected training times.

Nevertheless, although an operation-by-operation analysis does suggest that some operator jobs have been simplified and automated, it is difficult to see any evidence of this in available data. Effective automation and deskilling of operator jobs should reduce the share of apparel employment accounted for by operators and should lower their educational levels relative to the overall population. Neither of these developments have taken place. In 1970, 74 percent of the workers employed in the "apparel and related finished textile products" industry were operators--the large majority sewing machine operators. By 1980, that number had only fallen to 72 percent. Another eight years only brought the number down to 70.5 percent. Furthermore, these are not any less educated relative to the rest of the population than they were in 1970.[18]

There is also a broad consensus that the fixers and technicians in both the garment and textile industries need to be more skilled. Many of the experienced sewing machine mechanics are not only unprepared to work with the newest computerized equipment, but they do not even have the educational background needed to learn the new skills. Semi-literate mechanics who worked their way up from unskilled entry-level positions such as material handlers often give way to technicians with post-secondary degrees.

For example, as the Arrow Company began to use semi-automated sewing equipment they opened their own sewing machine mechanic school in Austel, Georgia. The managers established a policy that they would recruit holders of two-year associate degrees in electrical engineering and then send them to the training center for six months to learn sewing machine repair, followed by supplemental courses taken periodically. All of the experienced mechanics were given the opportunity to go to the training center for upgrading, but many simply were not able to read well enough to handle the school. Those who wanted to stay could, but in some cases they only worked on the simpler machines. Oxford Industries has also recently started a

[18]The 1970 and 1980 data are from the U.S. Bureau of the Census 1970:table 1 and 1980: table 1. The 1988 numbers are from the public use sample of the 1988 Current Population Survey.

mechanics training center. Another firm that has not changed its mechanic training requirements has contracted with a local technical service that is on call 24 hours a day for the repair and maintenance of electronic controllers. The service is available because the plant is near a large high-tech government research facility that has attracted a pool of skilled technicians to the area. Finally, another multi-plant firm is making do with older technicians without advanced training, but one of the firm's engineers is always on call to step in when needed.

Conclusion

Thus the industry's initial response to increased competition was to intensify its traditional strategy--straightforward cost reduction through the rationalization, elimination, and deskilling of direct labor. This approach has yielded limited success. The industry has had reasonable success in increasing productivity. Automation has been successful in the pre-sewing stages. There has been limited success in automating parts preparation and minimal progress in assembly. Average wages have also fallen. Nevertheless, there remain profound barriers to automation; significant advances are limited to the largest firms producing long-runs of standardized commodities. The tasks of marker makers, cutters, and some operators have been simplified by new technology, and there is evidence that some sewing tasks have been deskilled. But this trend, if it does exist, has not affected either the occupational structure or the relative educational level of operators. Moreover, to the extent that semi-automated equipment is available, the skill needs of mechanics have risen.

More significant, this strategy has not worked. Most of the advances discussed here were available in the late 1970s and early 1980s. Although such commodities as jeans, hose and underwear are still predominantly produced in the United States, in overall terms, the dramatic acceleration of the trade deficit took place despite falling wages and after most of the technological advances discussed here had become available.

Chapter 4

The Failure of Automation and Deskilling

Falling relative wages and reasonable productivity growth have not prevented the continued foreign penetration of domestic apparel markets. Indeed the greatest relative deterioration in apparel earnings since the early 1950s took place between 1970 and 1979. The growth of the apparel trade deficit accelerated in the late 1970s after almost a decade of sharply dropping relative earnings for apparel workers. And many of the advances in semi-automation described earlier were already available in the 1970s. Several factors thwarted the success of a cost-cutting strategy.

Increased Foreign Competition

First, there is a growing sophistication among foreign producers who are also backed by apparel export policies in developing countries. U.S. retailers, through their private label programs, and U.S. manufacturers have increasingly contracted with foreign producers for the production or at least assembly of apparel. As long as U.S. producers try to compete primarily on the basis of cost, then many segments of the industry are vulnerable to low-cost foreign producers. The limits to labor saving automation are simply too great to allow domestic producers to overcome the existing wage differentials. U.S. producers can maintain their advantage only in the most standardized commodities such as blue jeans and white underwear, where long production runs make automation more cost efficient, or in bulky or heavy garments, such as sweat clothes, that are costly to transport.

Labor Supply Problems

Second, the explicit low-wage strategy marked by years of falling relative wages have made the industry much less attractive as an employer. The resulting recruitment and retention problems are exacerbated by apparel's image as a declining industry. Traditionally, the industry has depended on recruiting an immigrant labor force, as in New York, Texas, and California, or a rural, agricultural labor force, as in the south. But the rural labor supplies are rapidly disappearing. The south, for example, has experienced solid growth during the 1980s. Although rural-based manufacturing remains an important source of employment in the region, apparel producers must compete with many other employers whose jobs carry higher status and usually higher wages. Garment jobs are lower down the queue of employment desirability. One producer in Georgia said that in one of his plants, every one of his mechanics, whom he paid $8 an hour, had been hired by a local refrigerator plant for $10 an hour. He also said that he would have liked to increase his operator force by 20 percent but could barely keep up with the turnover. The personnel manager at an apparel maker in Alabama said that getting fired from the firm was in effect only a temporary suspension since they were so desperate for experienced operators that they took almost anyone back after three months.

Three of the 13 firms I visited wanted to expand, but were seriously considering building new plants in rural areas in the south that were still not heavily industrialized or, in one case, in an area in which several plants had recently closed.

Unless wages or other characteristics of work improve, the industry will probably become more dependent on immigrant labor. In a 1987 study in New York, native born owners of apparel firms reported difficulties in finding skilled workers, while immigrant owners who had better access to the foreign born workers had an adequate labor supply (Bailey and Waldinger 1987). Although between 1978 and 1987 apparel employment in the U.S. fell by 16 percent and in the south by 6 percent, in California, where the industry can tap a large immigrant labor force from both Mexico and Asia, apparel employment grew by 14 percent during the same decade. But as we shall see later, there are serious problems with a strategy based on an increasing use of immigrant labor.

Fragmentation of Markets

A third factor that has thwarted the trend toward deskilling, and one that has far-reaching and complex implications for the industry, is the increase in variety and change taking place in apparel markets. Fashion seasons have started to proliferate. Liz Claiborne, for example, now uses six seasons--Pre-Spring, Spring One, Spring Two, Fall One, Fall Two, and Holiday. Even within seasons, retailers want constantly changing merchandise on their shelves. In addition, fashion consciousness has now spread to a wider range of the income distribution.

Industry analysts expect that the current 20 percent market share of commodity products such as men's underwear and socks that are sold all year will continue to fall.[19] Moreover, basic commodities now come in many more styles and colors than previously. The explosion of so called "active wear," which grew out of the very basic garments worn by athletes, is a good example, and denim can now be bought in hundreds of styles, weaves, and finishes.

The greater segmentation of markets and the faster changing of styles have shrunk the market for large production runs of identical garments. Production needs are more difficult to predict and this has resulted in an increase in markdowns and stockouts. Markdowns are necessary when retailers fail to sell items during the appropriate season. But since styles now become obsolete much more rapidly, forced markdowns have increased by 50 percent during the last decade. Losses from stockouts, which occur when retailers run out of hot items, amount to 8 percent of sales (OTA 1987:26-27). In 1984, the consulting firm, Kurt Salmon Associates, calculated "the opportunity cost from excessive markdowns, stockouts and excess inventories amounted to $25 billion a year, or 23 percent of the total retail value of all apparel sold in the United States at that time" (Harding 1988).

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[19]For a discussion of this see OTA 1987:chap. 2 and AAMA 1988b.

The rate of change of the entire environment in which apparel firms must operate has now accelerated. It is not just that managers and workers in the industry must learn a new way of doing things, but that they must develop the capability of much more frequent adjustment and adaptation. The industry has entered a period of faster change and increasing uncertainty in which the scope for the exploitation of economies of scale and capital intensive production is restricted.

This fragmentation of apparel markets and the increased level of uncertainty represent a serious challenge to the U.S. industry. First, the relative shrinkage of the market for basic apparel represents a decline in those areas in which the U.S. producers have tended to be strongest. Therefore, just as the opening of domestic markets to low-wage foreign producers meant that more players were joining the cost-cutting game that was the focus of the U.S. industry's production orientation, there was a shrinkage of the share of the market in which cost outweighs style and variety.

Second, there is evidence that imports tend to be higher in the more fashion-oriented sectors. At an anecdotal level, most of the best-known designer labels are either from foreign designers or American designers who produce abroad. Indeed consumers who want to be on the cutting edge of fashion generally turn to Italian designers. At a more general level, imports tend to be higher for women's clothes than for men's (although domestic dress production remains very strong). Within women's clothing, slacks and shorts, which are more standardized, are still predominantly produced in the United States, while well over half of U.S. consumed women's shirts and blouses are produced abroad. Sweater production is the king of imports. Indeed only about 12 percent of the wool sweaters for women consumed in the United States are made domestically (AAMA 1988a:Table 3).

Limits to Flexibility

I have emphasized that during the 1970s, the industry sought to confront its competitive problems through new technology and ever lower wages. This strategy did lead to moderate productivity increases and reduced costs, but there are decisive limits to its use in developing a flexible manufacturing system.

Flexible Production and the Contractor System: Currently the most flexible sectors in the U.S. industry are those that tap the immigrant labor supply through the contractor/manufacturer system. But as I have emphasized, in this sector, technology is archaic and the manufacturer, who interacts with the customer, is removed from the manufacturing process. This fragmentation makes it difficult for the manufacturer to bring about any significant changes in the production process, leaving them primarily dependent on a technologically backward system that derives its flexibility through the instability and low wages of employment in the immigrant sectors. There are three potential problems with reliance on this type of system for flexibility.

First, the immigrant system appears to be most effective in the lower to middle level women's wear sectors. At least in New York, makers of men's wear and better women's wear have had trouble using the immigrant labor supply.[20]

Second, as we shall see in the next chapter, emerging flexible strategies in the industry involve more sophisticated links among textile and apparel makers and retailers. These include integrated computer systems as well as more direct personal interactions. It remains to be seen what role a strategy based on primitive technology and unstable employment can play in these new systems.

Third, there is some evidence that the Immigration Reform and Control Act of 1986, which includes legal sanctions for employers who hire undocumented aliens, may limit the size and flexibility of the immigrant-based contractor system. For example, swimwear makers in Los Angeles reported that they had serious problems during the first year after the law took effect. They eased these problems during the second year by trying harder to hold on to workers. These manufacturers were accustomed to hiring and laying off as their business fluctuated, but as one executive stated, "We are forced to produce 52 weeks a year. We can't afford to have people coming and going." (Women's Wear Daily 1989) While this strategy may ease their labor problems by making employment more stable, it does reduce the flexibility

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[20]For a development of this argument, see Bailey and Waldinger 1987.

of the production process. A recent report by Roger Waldinger on the impact of IRCA on the New York apparel industry found only minimal impact, primarily because the industry simply was not that dependent on illegals. Nevertheless, Waldinger did argue that:

> The sanctions' greatest effect appears to be on small, immigrant-owned, neighborhood firms. Since these firms recruit from a local labor supply and cannot compete with the industry standard on wages, working conditions, or weeks of work, they have been more dependent on illegal immigrant workers. The enactment of sanctions appears to have reduced their ability to recruit illegal immigrants (Waldinger 1989).

And these small firms were a highly flexible component of the system. Thus for several reasons, it is unlikely that the industry can rely on the contractor system linked to the immigrant labor supply to confront the increasing fragmentation and change in apparel markets.

Technology and Flexible Production: I have already emphasized the severe limits to automation in the industry. But technology that can both reduce labor content and increase flexibility--flexible automation--is even farther off. Indeed most of the advances that have been made in automation have been on specialized machines that are not flexible. Thus, micro-electronic technology can play only a limited, albeit crucial, role in the development of flexible apparel manufacturing.

It is in marker making and cutting that most progress has been made in automation and flexibility. This technology will become even more accessible if prices for computerized cutters drop sharply. But even in this case, computerized cutting is most effective for solid colors. If stripes or plaids must be matched, especially if they have to be matched in two dimensions, then many of the pieces must be cut by hand in order to insure the match. Thus cutting shirts with two dimensional matches takes about twice the labor required for cutting pieces for solid colored shirts.

The search for flexible automation in sewing is even more frustrating. Of course the sewing machine is cheap and flexible, but the drive to speed up and to automate the sewing machine led to machine specialization. Expense and specialization escalated as hard automation was developed so that the machines ran through particular cycles. These machines cut labor sharply but had to be dedicated to one task.

Although recent technological advances do offer new opportunities for flexibility, the costs are still high. In an industry that is accustomed to using sewing machines that cost less than $5,000, automated self-loading sewing machines now cost between $15,000 and $40,000. The automatic pocket setter mentioned above costs $40,000 and still requires changes in hardware when style changes are made. Thus, because of the cost and the lack of flexibility, most semi-automated sewing machines are still found in large factories producing standardized garments. Moreover, this type of automation has been more successfully applied to apparel made of woven rather than knitted fabric. Indeed, other than in two shirt factories (using woven cloth) owned by Fortune 500 companies, I saw few of these semi-automated machines.

Materials handling remains the central barrier to flexibility. It is in the stage of the production process that is completely divorced from the material handling--grading and marker making--where flexible automation has advanced farthest. It is interesting that even in the pre-materials stage, the greatest barrier to the complete computerization of the design/pattern-making/grading/marker-making process concerns the inability to define mathematically the drape of the fabric for some types of garments--the interaction of gravity, the characteristics of the fabric, and its positioning on the human body. This gets to the heart of the problem--if even with the most powerful computers, scientists are unable to model the behavior of some fabric, it is not surprising that it is difficult to design a versatile machine that can handle that fabric. Although development projects are making slow progress, dramatic breakthroughs in flexible automation of the assembly process are not imminent.

Conclusion

Increased import competition, labor supply problems, and the fragmentation of apparel markets have all called into question the viability of the industry's cost cutting, labor reduction strategy. Automation and wage cutting are not adequate for successful competition based on cost cutting alone. Moreover, developments in apparel markets and the general acceleration of change have reduced the market share for standardized commodities produced in long runs. It is in these lines that the traditional strategy has been most successful.

The greatest advantage that U.S. producers seem to have is their proximity to the huge domestic market. But the traditional production system was not based on the flexibility and fast turnaround times needed to exploit the advantage of proximity.

If U.S. producers move away from their traditional reliance on cost cutting through the detailed rationalization of the production process, what can replace it? We will turn to those issues in the next chapter.

Chapter 5

The Emerging System of Production

Some apparel firms have now begun to shift away from a system that emphasizes cost cutting through the reduction of labor content and the rationalization of separate tasks in the production process. These firms are trying to develop systems that emphasize greater flexibility, faster production times, and greater interaction and cooperation among textile makers, apparel firms, and retailers. I argued in the last chapter that neither the contractor system nor modern technology alone can meet the emerging needs for change and flexibility. Therefore in this chapter the role of organizational change is emphasized. I assess how extensive the change has been and, through a concrete example of two alternative production systems, argue that the movement from a cost reduction strategy to a more flexible, market-oriented strategy requires fundamental changes in human resource policy.

The Quick Response movement is one of the most widely heralded developments in the apparel industry. The goal of Quick Response is to minimize the length of time between an order at the retail level and the final delivery of the goods, a process that traditionally took many months. Materials had to be ordered months before a fashion season and once the season started, there was no time to reorder hot items. During the months of waiting, the material was actually being worked on for a few hours at most. Except for foreign goods shipped by sea, including even essential travel time would only increase the total by a few days. Ideally, Quick Response would allow retailers to order only small quantities before the season, and then reorder popular styles, thus avoiding both stock-outs and mark-downs. Shorter production times save on inventory carrying costs and allow more immediate responses to changing market demands. Production planners can reduce their reliance on market forecasts, which were never reliable, but which have become even less useful as product changes have accelerated and markets have become more fragmented.

Cutting the in-process time can be done by reducing the delay between the emergence of a trend and the order to the producer, by reducing the time it takes to produce the goods, or by reducing the time that they sit on loading docks and in warehouses. So far, the main thrust of Quick Response has not been focussed on production time. Certainly for standardized items this makes sense. Given past advances in productivity, by far the greatest savings in time could be realized by reducing ordering and warehousing time.

Indeed most attention has so far been given to inventory control at the retail level and inventory-generated orders to suppliers. In theory, an order to a sheet producer, for example, would be generated automatically when the sheet inventory at a department store falls below a given level. Ironically, the key here is the buyer's inventory control. The communication to the producer may be a convenience, but the sine qua non of the system is the information on sales. Another key aspect of this system is the development of a universal nomenclature and the use of computer readable labels (bar codes) on product packages to facilitate inventory tracking. Other important features involve timing of production to minimize waiting, and more attention to quality in order to cut down on inspection and to reduce the need for back-up inventories. According to the more ambitious Quick Response scenarios, trucks will be loaded and deliveries will be timed to minimize handling upon delivery.

One of the most important developments associated with Quick Response has been the growth of cooperative interactions among suppliers and customers. This growing cooperation contrasts to the more adversarial, arms-length, and market-mediated relationships that previously dominated the industry. But without increases in flexibility and throughput speed in the manufacturing processes themselves, the Quick Response movement could degenerate into a struggle over who holds the inventories. Retailers can respond quickly to shifts in market demand if their suppliers have goods in their warehouses. It is not surprising that most of the progress in Quick Response has taken place among commodity producers--for example, between denim mills and blue jean manufacturers that produce relatively standardized products. But inventory at any level is precisely the problem that the strategy is designed to avoid, especially in styled goods. The process must also include more flexible and responsive manufacturing processes. In the previous chapter I argued that the flexibility demands of modern apparel markets could not be met either by expansion of the contractor system based on immigrant labor nor by technology alone. Thus apparel makers have turned to organizational change.

Organizational Change

The reorganization of the flow of material among workers is an important component of efforts to increase flexibility and production speed. This reorganization comprises a movement away from the functionally-oriented organization that characterized the traditional apparel production system. Rather than dividing factories into large departments specializing in carrying out one function, managers are increasingly using a product-oriented strategy in which plants are organized into smaller departments that can carry out more steps of the production process. These departments are oriented toward particular products, markets, or customers. For example, while functionally organized plants process orders one at a time, product-oriented plants can process several orders of different sizes and cycle times simultaneously. This allows more flexibility in handling each order. The reduction in in-process inventories that accumulates between functional departments is a central component of product-oriented organization. Furthermore, in a product-oriented organization, some output from several orders will be completed every day, thus allowing a more efficient flow of goods to the customer. In addition to changes in the general organization of the departments within plants, some apparel firms are trying to eliminate the in-process inventories through developing alternatives to the bundle system. While it may take several days for a garment to move through a bundle system factory, the process using one of the alternative systems can take only a few hours. (These alternatives will be discussed in more detail below.)

Early experience with product-oriented systems and attempts to reduce in-process inventory have been encouraging. The consulting firm, Kurt Salmon Associates (KSA) estimates that in some cases, Quick Response can cut the overall cycle from fiber production to the retail sale from over 60 to about 20 weeks. And, according to KSA, Quick Response, through lower inventor levels, lower risks, and faster inventory turnaround, could save enough to compensate for a 25 to 35 percent differential in cost between the wholesale price of domestic and foreign produced apparel (Kurt Salmon Associates 1986:1-2 and Kurt Salmon Associates 1988b:13).

The Spread of Product-Oriented or Flexible Systems: How extensive is the shift toward more flexible, product-oriented production systems? Certainly the industry's major institutions are very much involved with testing, implementing, and promoting the Quick Response strategy. Almost every issue of the major industry publications in both textiles and apparel such as <u>Textile World</u> and <u>Bobbin Magazine</u> includes articles on some aspect of Quick Response. The industry's leading consultant, Kurt Salmon Associates, and the most broadly based trade association, the American Apparel Manufacturers Association, are both at the forefront of the Quick Response movement. And representatives of retailers, apparel makers, and textile and fiber producers have made significant progress in developing communications standards that are necessary for the type of interfirm coordination necessary for Quick Response. The activities associated with Quick Response are significant partly because they represent the creation of an institutional framework for cooperation among previously antagonistic firms and industries.

The current obsession with flexible manufacturing contrasts sharply to the industry preoccupation with automation as recently as the early 1980s. The evolution of $(TC)^2$ is a case in point. It was started as an attempt to develop straightforward labor saving automation, but its headquarters in Raleigh, North Carolina now emphasizes technological diffusion and experimentation with flexible manufacturing work organization using commercially available equipment. The Technical Advisory Committee of the AAMA makes a presentation every year at the Bobbin show (the industry's annual trade show). In 1988 and 1989, this presentation was about flexible manufacturing but had very little to say about technology _per se_, instead concentrating on production process organization, personnel policy, and management issues.

These developments are also reflected at the plant level.

All of the plants that I visited, whether they were owned by a small contractor in New York with a handful of workers or by a Fortune 500 firm with thousands of employees, were producing more styles and products than they were ten years ago. For example, a sleepwear manufacturer had increased the number of styles he produced from 100 in the mid-1970s to over 300 in 1988. Previously he had shipped 90 percent by truckload and 10 percent by United Parcel Service. Now 99 percent of his shipments are through UPS. He had typically had $5 million to $6 million in inventory but now he rarely has as much as $2 million, even at the peak season. Another producer of men's slacks and shirts said that his average cutting size had fallen from 100-150 ten years ago to 40 today. He also said that he sends out orders through United Parcel Service as small as one or two items. A formal men's wear producer had increased the number of styles from 12 ten years ago to 90 in 1988. A women's intimate wear maker in the mid-west produced four times as many items as he had 10 years ago. Previously there had been two seasons a year, but that had increased to four and now in each of those seasons, they are producing 300 styles in three or four colors. A sweater maker in Queens commented that during the 1970s he produced more or less the same small number of styles during the entire production season from February to September. Now he has weekly and sometimes daily changes and his rush season is much shorter--from May to September. In the 1970s, 85 percent of the production of an integrated knitter in Tennessee had been white underwear. Now they produce underwear, "fleecewear" and other active wear in many different colors. Textile producers also point out that their orders from apparel makers are much smaller, thus textile plants are also producing more styles (Bailey 1988). In one well publicized example, at Greenwood Mills, the average dye-lot had dropped from 120,000 yards to 11,000 (Kurt Salmon Associates 1988b:14).

Six of the seven firms that I visited outside of New York were at least experimenting with some form of product-oriented organization. All of these efforts had been initiated within the last five years. To assess the spread of new production techniques, the American Apparel Manufacturers Association conducted a survey of its members in 1989. Ninety-two apparel manufacturers employing 143,000 workers in 508 plants responded. In 1985, only one percent of the production workers in these firms were being used in production processes designed to reduce in-process inventory. By 1988, that share had risen to 7 percent, and according to current plans, 20 percent would be used by the early 1990s (AAMA 1989:3-4).

There are clearly segments of the industry in which these developments are much more common. None of the firms in New York that I interviewed were using advanced flexible systems designed to reduce in-process inventories. Most New York producers continue to rely on a strategy based on the availability of a low wage immigrant labor force. Nevertheless, given the conservative tradition of the industry--many contractors still do not use cheap, off-the-shelf technological advances that have been available for 20 years--in a short time, there has been significant growth in the development of more flexible systems.

In the next section we take up the question of whether this development requires major changes in human resource strategies or whether technology can be used to bring about the necessary change within the old system of labor relations.

Alternative Human Resource Strategies

So far I have argued that there is a growing shift away from the traditional production system. What does that imply for the viability of the traditional human resource management system? This section addresses that problem by examining two alternative apparel production techniques--the module system and the Unit Production System (UPS). Both of these systems are designed to reduce in-process inventory, although they are based on contrasting human resource strategies. Indeed, the UPS can be seen as yet another attempt to find a technological solution to the industry's problems that avoids major changes in human resource policy. The module system requires much more extensive changes in personnel philosophy and practice.

Unit Production Systems: The Unit Production System (UPS) is a device for transporting in-process work among operators. In the system, all of the pieces needed for one garment are hung from a hangar which moves along a rail. Each hangar is routed to appropriate stations where the operator performs her procedure, often without having to remove the pieces from the hangar. When she is finished she sends the hangar back to the central rail to be routed to the next station. The actual tasks that the operators perform are very much the same as in the bundle system.

The UPS can significantly lower throughput time and inventory levels. Garments that enter the system in the early morning are usually complete by noon. The two UP systems used by firms in the study sample both allowed less-than-one-day cycle times. In one, throughput time fell from 2 weeks to 4 hours and according to one plant manager, in-process inventory had fallen from 4000 dozen units to 400 dozen units. And sometimes in this plant they were actually running 16 different styles at a time on their two UPS lines. Also, according to published reports, work-in-process inventory dropped by 70 percent at an Oshkosh B'Gosh plant in Kentucky after the installation of a UPS (AAMA 1988b:21).

The newest unit production systems also have sophisticated information capture and retrieval capabilities that allow the manufacturer to track each garment, to plan the sequencing of the various orders, and to keep track of the productivity of each operator. The ability to route each hangar individually also allows more than one type of garment to move through the system at the same time (although the number of work stations on the system limits this since it is inefficient to have the same operator work on different garments at the same time).

Savings on direct labor content have been reported as high as 20 percent, but it is unlikely that operations that were well run before the installation of the UPS can reduce their direct labor by more than 10 or 12 percent. About half of the savings comes from the elimination of bundle handling--when they finish each bundle, the operators must stop work, fill out a slip of paper, and tie up the completed bundle--and half from the greater ease with which the hung garment pieces--as opposed to picking up a piece from a pile--can be handled (Roberts 1986).

The UPS is essentially an assembly line and as with most assembly lines, it introduces an element of mechanical pacing of the work speed. Because of the mechanical control of the work pace and the elimination of interruptions needed to handle bundles, employers point out that one of the advantages of the UPS is that it enhances the "rhythm" of the work. As one report on the UPS stated, "There can be little question that a UPS provides a positive pacing effect. The pressure to produce is heightened, and constant workflow sets the tempo" (Roberts 1986). Moreover, the way most UP systems are set up, each operator is surrounded by hanging garment parts and is therefore isolated from her co-workers. Individual piece rates continue to be the basis of compensation. Thus one effect of the UPS is simply to intensify the work process for the individual.

At least on paper, the UPS seems to solve many of the industry's problems without any changes in human resource practice. The piece rate system can be maintained and the actual sewing tasks are not changed. Indeed, material handling is somewhat easier. All of the planning and coordination is still in the hands of the supervisors and engineers. Moreover the supervisors now have more immediate information and more direct and immediate control over the routing of material among the operators. The operator's job is simply to sit and sew the material that is delivered to her station by the system. Thus, from this point of view, the UPS appears to be more consistent with traditional fragmented work organization and the search for ever-simplified tasks for lower level workers rather than a move toward more employee involvement.

But this image of the UPS is misleading. There remain thorny problems for management and planning that result from the attempt to maintain the individual production orientation and piece rates while trying to eliminate in-process inventories. Since it is impossible to predict exactly how fast an operator will work, in the absence of buffer inventories, variations in work speed can cause some operators to run out of work, or the limited space for work waiting between operations to be overwhelmed. Since employees are earning piece rates, running out of work is a major cause of employee discontent. Thus in unit production systems, the supervisors are constantly shifting workers among tasks or simply removing work from the rails in an attempt to balance the production line. In one plant workers often changed jobs five or six times a day. Shifting workers creates additional problems. The variation in speed as an operator gets accustomed to the new task can wreak havoc with the process. It also reduces her piece rate income unless the firm pays premia above the basic rate until the operator reaches normal efficiency. And while the operator is getting up to speed, the supervisor must use additional workers to keep work flowing to downstream processes; once the operator has achieved the expected efficiency level, the additional workers will overload the downstream capacity to hold in-process work. Thus to the disappointment of those who would like to deskill the apparel plant, the UPS operates more efficiently with operators who are proficient and experienced at a variety of tasks.

Many of the difficulties caused by the problems of production sequencing and balance would be reduced if the UPS were used primarily for standardized commodity garments. Indeed, one sleepwear producer emphasized the difference between the use of the UPS to produce the dozens of style variations for women's sleepwear, and its use to make the few standardized children's sleepwear styles he produced. He was very satisfied with the children's production line which ran smoothly and efficiently, but he had serious problems with line balance and operator dissatisfaction in his women's wear production line. The manager of an intimate wear plant who had installed a UPS remained a strong backer of the concept but had found the line balance problems more difficult and frustrating than he had expected. In another plant, in order to reestablish balance, some supervisors were in effect accumulating more in-process inventory by removing hangers from the rails and storing the incomplete apparel in bins. Another alternative is to use some of the stations simply for storage. But these measures mitigate the benefits of the system.

Modular Manufacturing: Modular manufacturing is an alternative technique for organizing the workflow among operators.[21] This system, when it works, is flexible and minimizes in-process inventory, but it requires a fundamental change in human resource management and training.

In modules, groups of operators work together to assemble an entire garment. The machines are usually placed in a circle or U-shaped configuration. After each operator completes her task, she passes each piece or garment directly to the next operator. Ideally there should be only a few pieces between two operators. Thus modules drastically reduce in-process inventory. Another advantage is that they eliminate the time involved in handling the bundles. For most garments it only takes a few hours for a given piece to go through the production line.

Although the actual sewing tasks carried out by workers in modules do not differ from the tasks performed by bundle workers, the module system requires fundamental changes in the industry's human resource practices. Supervisors and engineers can no longer focus on workers in isolation but must consider the effect of the action of each worker and of the design of each task on

[21]For descriptions of the module system see Bennett 1988 and AAMA 1988b and 1989). Five of the thirteen firms that I studied for this project had sewing module pilot projects.

the contemporaneous functioning of the group. Workers themselves must become involved in the quality and pace of production of their co-workers. Theoretically, if one operator falls behind, then another group member will help her catch up. In well-functioning modules, any imbalances in the production process will be corrected in this way without any intervention by the supervisor. This obviously requires some of the operators to be able to do a variety of tasks.

Machine maintenance and repair are much more important in modules than in the bundle system since a machine breakdown can quickly stop the entire group. In some cases, the mechanics are also members of the module. For example, in one shirt plant, the managers plan to teach the operators some of the basics of machine maintenance and repair so that the operators can either repair small problems or at least have some sense of the cause of the problem when a mechanic arrives to correct it.

In three of the five modules I studied, group members had some role in setting the group goals and deciding how they will be met. Some managers place a good deal of emphasis on developing a team spirit and encourage competition among the teams. Module advocates argue that the system will be most effective if each group is encouraged to take responsibility, as a group, for the amount and quality of the output.[22] Peer pressure plays an

[22]If the group is responsible for the quality, then each worker in effect inspects the previously completed procedures. As a result errors are corrected immediately. With the bundle system, operators have no incentive to notice or to do anything about quality problems from earlier operations. Indeed, taking

important role. For example, a worker in one plant habitually skipped part of her lunch hour so that she could be sure that she kept up with her group. Every manager who had tried a group system argued that peer pressure tended to result in lower absenteeism.

With the elimination of buffer inventories, problems at one stage of the process will rapidly spread to others. In the UPS, it is the supervisor who must scramble to adjust. The module system is premised on a group solution to these problems--mutual assistance among the work group. Since the production in this configuration is a group effort, piece rates must be abandoned. Operators are paid a straight hourly rate or some form of group bonus. In general apparel makers plan to increase their use of group incentive plans. According to the AAMA survey, in 1985, only 7 percent of the workers employed by firms in the sample were paid at least partly through a group incentive system. By 1988 that number had risen to 8 percent, and according to current plans, would rise to 25 percent by the early 1990s (AAMA 1989:27).

Since the focus shifts from the individual to the group, the management of the interactions among the members of the group is a fundamental determinant of the strength of the module approach.

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time to point out upstream quality problems would actually reduce an individual's piece rate income. Not only does the group as a whole pay more attention to quality, but the individual members feel pressure from the group to avoid errors since everyone is affected.

The training director of one firm that had module pilot projects at several factories emphasized that the single most important factor in the relative success of the projects had to do with how the team dealt with its slower members. For example, while most of the groups had increased productivity after switching from the bundle system, the productivity of one group that produced pants had actually declined. Sharp resentments developed against the slower members because they were holding down the team production, while the slower members resented the hostility of their colleagues. Clearly, the dynamics of the group interaction are a powerful force in the behavior of the team, yet those dynamics can develop in constructive or destructive channels. The interactions among the team members can be a powerful motivator, but there is also potential for the development of antagonism and hostility. Thus modular configurations require a high degree of communication and cooperation among the operators, the mechanics, and supervisors. This type of activity is completely absent in a traditional bundle plant. And since group cohesion and the nature of personal interactions are so important, the typical 30 percent annual turnover rates among operators becomes a greater barrier to successful operation.

Pilot projects have indicated some dramatic improvements. Arrow cut its throughput time for the assembly of men's shirts from five days to one hour; Joseph & Feiss, a men's-wear maker in Cleveland, cut cycle times in the cutting room from thirteen days to two days; and the Artex Company was reported to have cut cycle time for screen printed tee shirts from eight days to one day. Oshkosh B'Gosh reduced sewing throughput time from 15 to two days. The H.L. Miller Company, a producer of women's dresses, cut its sewing cycle time from 60 to 15 days. These experiments also suggest other benefits such as reduction in space requirements, better quality, and greater employee satisfaction.[23] It remains to be seen how effective the concept will be when it moves from an experimental stage to firm-wide implementation and if it spreads to a wider variety of firms. Selected employees can be used in pilot projects and many of the firms that have carried them out so far have traditionally been the most progressive and innovative. Moreover, work process innovations are notorious for dramatic early results that fade after the novelty wears off. Nevertheless, the initial experience is encouraging for managers who have tried modules or other types of group-oriented innovations.

The unit production and module systems compared. Although both the UPS and the modular systems are designed to speed up production and reduce in-process inventories, they represent fundamentally different human resource strategies. While the UPS increases the isolation of each operator, the modular system throws them together in groups--indeed, pay is based on collective output. With the increase in the interdependence of the operators, there is a concomitant increase in the importance

[23]These examples are drawn from AAMA 1988b and 1989; and Kurt Salmon Associates 1988b.

of coordination. While in the UPS the interdependence is managed through the technology of the system supplemented extensively by the floor supervisor, in the modular system, this coordination is achieved by a group process that increases the pressure on interpersonal and social skills. The supervisors in modules are therefore much more involved with the dynamics of the interpersonal relationships within the group. In the UPS, the supervisors are in a constant battle to keep the operators employed and the line balanced.

Does the UPS offer a realistic opportunity for flexible, fast throughput production that does not require fundamental changes in human resource management? Experience with these systems is only beginning to accumulate, but it appears that this is unrealistic. Cross training is more important, and given the low inventory levels, machine breakdowns are potentially more costly. Although the UPS appears to allow the maintenance of the traditional human resource strategy, it may be most effective if it is combined with changes in personnel practice. Thus it could be used as a transport facility for a module system. Newer UP systems are now being configured to reduce the isolation of each individual worker and to allow them to help each other as they would in the team approach. $(TC)^2$ is also experimenting with a UPS configured this way. The manager of one plant believed that his UPS would be more effective if the plant abandoned piece rates and moved to a group bonus system.

Conclusion

The traditional apparel production system was based on maximizing, in isolation, the productivity of each stage of production. The maximization of productivity at each step, so the logic goes, will result in maximum productivity for the whole process. There are two problems with this argument. First, sacrificing productivity at one step may increase overall productivity. The second problem results in particular from recent developments in consumer tastes and in the structure of competition. Even if the fragmented approach was most productive, it was no longer able to deliver the right product at the right time. A highly productive process is not much use if its output sits in a warehouse or never gets produced.

Traditional production techniques still dominate the industry in many areas, particularly those that have access to an immigrant labor pool, but in the last five years, apparel makers have recognized these problems and a growing number have begun to develop production processes, internal factory organization, and inter-firm relationships more appropriate for the current environment. Modern technology is crucial, but this only accounts for a part of the change. Lead times, buffer inventories, and other types of slack and margins for error and relaxation are, at least in principle, all being squeezed out of the production system. Workers within firms and firms within the supply chain are now involved in a more integrated network and are therefore much more interdependent. In the following sections we will examine what implications this new system has for human resources, skills, and education.

Chapter 6

Skills, Training, and Education

The traditional cost- and production-oriented production systems was matched by a set of common recruitment, employment, and training practices. These in turn were characterized by attempts to reduce the skill requirements of employees, especially operators. As pressure has mounted on the traditional production system, its associated human resources practices have also become increasingly troublesome. This chapter first examines the skill requirements of the more flexible systems beginning to emerge in the industry. The second part of the chapter describes the existing system for educating and training apparel workers and discusses whether it is adequate to meet the future needs of the industry.

Skills

When a firm moves from a functional organization to a product-oriented organization and especially if teams are introduced, it is much more difficult to rely on extreme specialization among workers. As we have seen, apparel firms that have adopted unit production systems or modular configurations have increased their emphasis on cross training. According to the American Apparel Manufacturers Association survey, in 1985 only 12 percent of the workers in the firms in the sample were cross-trained for more than two jobs. By 1988 that number had increased to 16 percent, and according to current plans, 27 percent would be prepared for two or more jobs by the early 1990s. In all of the cases described in the AAMA's 1989 report, all firms that used modules or unit production systems had more workstations than operators. Thus, at least some workers always performed more than one task (AAMA 1989:13, 29). And as styles change more rapidly, workers will have to be more adept at those tasks required to reconfigure their equipment.

Moreover, the efforts to increase throughput speed through the elimination of buffer inventories transforms the production process within a factory. It creates an immediate interdependence among the various workers and processes involved in production. Now the planning, execution, and management of each task must take into account the multiple relationships with all of the other tasks in the plant. And as a result of the reduction in inventories, the proliferating production variety, the increase in throughput speed, and the accelerating pace of product as well as technological change, it is much more difficult, and less efficient, to plan out every contingency that an employee must face, to refer problems to specialized departments, or to await instruction or permission from superiors. More than in the past, workers will have to be able to figure things out for themselves.

In product-oriented organization and especially in teams, workers experience more frequent and complex interactions with their co-workers. Indeed, as I have pointed out, the success of many teamwork experiments depends primarily on how those interactions are managed. Furthermore, this increasing level of interaction extends across occupations--among supervisors, mechanics, and operators.

The changes in the relationships among firms called for by the proponents of Quick Response amplify many of these new demands. While firm reorganization integrates the worker into broader aspects of the operation of the firm, the increasingly interactive links among firms project that integration beyond the boundaries of the firm. More employees in any given firm must have a stronger understanding of the operations, strategies, and needs of supplier and customer firms. There may also be an increase in direct interaction among employees in different firms.

The increasing pace of change is a fundamental characteristic of the emerging environment in which apparel firms must operate. It seems reasonable to expect that changes in technology, markets, and production processes will continue to take place at a much faster pace than in the past. It is this increasingly endemic change, as much as the specifics of the new technology or work organization, that is driving changes in required skills and abilities. This need for adaptability involves a switch from a concrete understanding, based on experience and informally acquired on-the-job training, to a more conceptual or theoretical understanding of the work in which employees are engaged. Only if workers understand the deeper logic underlying their work can they adjust to new tasks without having to be shown, step-by-step, what to do.

There is a now a well-established body of research that associates education with ability to cope with change. Charles Schultz argued 15 years ago that education improved a worker's ability to deal with "disequilibria." Other research shows that industries experiencing faster technological change tend to employ workers with higher levels of educational attainment and to provide more on-the-job training to their employees (Schultz 1975, Tan 1989, and Bartel and Lichtenberg 1985).

In the next paragraphs I look more concretely at changing skills and educational requirements for supervisors, mechanics, and operators.

Supervisors: One of the most serious problems in product-oriented factories concerns education and skills of the supervisors. Without inventories, all of the steps of production interlock, whether it is through a mechanical device such as the UPS or through direct interaction among workers as is true with the modular system. The supervisors must have an integrated view of the process that they are overseeing and must be aware of the multiple relationships between the parts of the system. They can no longer deal with each problem in isolation. When a supervisor moves an operator from one task to another, he or she must be able to understand the eventual effects of the withdrawal of that operator from the original task. This requires an ability to conceptualize the entire process that was not necessary before. Indeed, in plants organized into functional departments, supervisors not only did not have to understand the interactions among the functions, but they often only had responsibility over one function or a restricted range of functions.

Supervisors must also have the ability to manage the more complicated group dynamics in product-oriented factories. Indeed in modules or teams the supervisors' role is ambiguous. They must manage a more interactive process, yet as a result of the group decision-making process, they have less direct control.

Mechanics: Mechanics need more advanced technical skills, but their jobs have changed in other ways as well. If plants use multi-function departments, it is more difficult for mechanics to specialize in a small number of machines. Successful operation without buffer inventories requires mechanics with deeper and more abstract knowledge of the equipment. For example, when one large firm first installed some sophisticated semi-automatic equipment, the management expected that their mechanics would have trouble with the advanced electronic and hydraulic components of the machines. And indeed they did. But the managers also found that the mechanics had a poor understanding of the sewing components that they had been repairing for years. Previously, they could take their time in repairing a broken machine, thus using a trial-and-error method. If that did not work, they could take the machine out of service and tinker around with it until they got it going. Their knowledge was entirely experience-based. As one manager put it succinctly, "those mechanics couldn't fix a damn thing that they hadn't fixed before." Without the buffer inventories, broken machines quickly led to downstream disruptions. One manager estimated that in a sewing module, each minute that a sewing machine was out of service cost $3 to $4. In one company, these problems led to the development of training procedures designed to give the mechanics a much more sophisticated and complete knowledge of all components of the machines they had to work with, but the catalyst for changes was as much the new system of production as the nature of the new equipment. Among the apparel firms that I visited, two had not worked on upgrading their mechanics, depending rather on one of the firm's engineers, who serviced several plants, or on an outside repair service. But these two firms did not emphasize flexible or quick turnaround manufacturing. It was therefore less crucial that equipment be repaired immediately.

Operators: Operator jobs are also affected by the new environment. They must master more tasks; they must engage in more extensive interactions with other workers, mechanics and supervisors; and they must be more able to change and adapt to new equipment and to faster changing styles and tasks. Information from the firms in the study sample suggests that firms that are developing a more responsive and flexible production process look for a higher quality and better educated workforce.

For example, one firm had two factories, one specializing in standardized goods produced in long runs and another that made small batches of special order items. Workers were trained at a central location and assigned to one of the factories when their training was complete. They had established a policy of assigning the best operators to the special order factory. Another manager of operators in a large apparel establishment pointed out that because of the accelerating number of changes in machines and sewing operations, it was often difficult to give complete and detailed instructions to all of the operators for every small change, thus operators were more likely to have to make adjustments on their own. This firm arranged literacy remediation for employees who were interested and required all employees under the age of 19 to attend adult basic education classes. And in a factory that had introduced a modular system, in order to minimize machine down time, which could quickly disrupt the production of the entire group, operators were instructed in how to do simple trouble shooting when their machines broke down. If they could not get the machine going, then at least they had done some preliminary analysis by the time the mechanic arrived.

In another example that is at least suggestive, one firm that had factories in different regions found that they had an easier time implementing a completely new production system in one factory in which over 80 percent of the workforce had graduated from high school. The process was much slower in those factories in which the high school graduation rate was lower.

To be sure, some managers argue that sewing machine operators do not need a high school education. Nevertheless, in my sample, those employers who asserted this most strongly also tended to be those who used older equipment and who did not emphasize flexibility. For example, the men's wear maker in New York who stated that his engineers were there to reduce the need for labor had an antiquated factory. He had increased the number of styles in the last decade but he still considered himself a mass producer of a standard commodity, albeit an expensive commodity. Moreover, he was in a very specialized niche in which he only had one major domestic competitor and in which there was virtually no foreign competition. Another manager who favored workers without high school degrees had had to reduce the number of styles that he produced over the last three years in order to save on the changeover costs. And a third who was unable to attract high school graduates had made no attempt to adjust his production process to increase turnaround time despite the interest on the part of his most important customers to develop a quick response relationship. This manager did ship very small orders, as small as one item, but he did this by maintaining a very large inventory of finished goods.

Of course, these examples cannot prove a direct link between the educational level of the operators and the success of the firm. Nevertheless, in this sample of firms, there was a very strong relationship between concern about the basic education of the workforce and attempts to implement modern technology or innovative production processes.

So far I have focussed on the educational implications of changing markets, technology, and production processes. It is also important to consider the implications for human resource practices of the changing educational level of the available labor supply. The flow of immigration may continue to provide a supply of workers willing to work at traditional garment operator jobs. But in the absence of a major and long lasting recession, which in any case is hardly something to be wished for, attracting a broad-based labor force will be increasingly difficult. The programs and experiments that some apparel firms are trying have the potential not only to improve productivity but also to make the apparel jobs more desirable. Many firms may not have the luxury of clinging to traditional human resource practices even if it were technologically feasible.

Education and Training in the Apparel Industry

The employment structure and training system in the apparel industry has been and still is simple and straightforward. The closer employees got to the actual production of the apparel, the less likely they were to have any significant formal training. Operators, mechanics, and most supervisors entered the plants as unskilled workers and learned their skills on the job.

Some plants had vestibule training (formal training that takes place at the plant off the factory floor) for beginning operators and others simply started young workers on the sewing room floor, assigning them the simplest tasks at first. Usually one of the experienced operators was given the responsibility for training the novices until they got up to an average level of proficiency. Highly skilled seamstresses and tailors sometimes did have formal training, but this was often acquired in Europe. Second generation immigrants sometimes learned more or less as apprentices from relatives or fellow immigrants, but these skilled workers are now reaching retirement age, creating a serious problem for some sectors of the domestic industry (Bailey and Waldinger 1987).

The supervisors were usually promoted from the ranks of older experienced operators. Formal supervisor training did not exist. Mechanics received even less formal training than the operators. They usually learned their skills by following experienced mechanics around while they worked. If more sophisticated equipment was purchased, the machinery manufacturer provided some instruction.

There has been a longer tradition of formal education for some of the higher positions in the industry. Schools such as the Fashion Institute of echnology (FIT) in New York trained thousands of designers, purchasers, managers and marketers. The closest that these schools got to training production workers was in their programs for marker and sample makers. Engineers in the industry who designed equipment and plant layout and who set piece rates either graduated from general engineering schools or from the specialized textile and apparel schools such as FIT, Philadelphia College of Textiles and Science, or Southern College of Technology.

The substantial formal training at FIT, Southern Tech and similar schools is overwhelmingly oriented toward design, marketing, engineering, and various management positions. The interest in these programs and the demand for their graduates has risen in recent years. In the early 1980s, the textile/apparel program at Southern Tech was almost dead, enrolling only 25 students. In 1988 they had about 100 students in their two and four year programs--60 in apparel and 40 in textiles. According to the director of the programs, even more graduates could be placed if they were available. Similar reports come from the North Carolina State University School of Textiles and the Philadelphia School of Textiles and Science. Large apparel and textile firms also recruit from general universities and business schools. Obviously many firms in the industry have recognized the need for post secondary graduates in a variety of technical and managerial positions (although apparel firms undoubtedly lag behind textile firms in this respect). Indeed, a Southern Tech advisory committee of industry representatives actually paid the salary and expenses for a full time staff member to recruit for the textile and apparel program.

The industry seems pleased with the graduates of these programs and if demand stays strong, they will undoubtedly expand. It is not clear how much emphasis is put on education for the new environment in which the apparel industry must operate. Certainly personnel at most of these schools are well aware of most of the technological, market, and organizational trends that are taking place. The specialized schools are all closely associated with industry consultants and the major trade associations and therefore can keep up with the most recent developments. The Defense Logistics Administration (DLH) has recently funded technology demonstration projects in four schoc and the DLA has emphasized management for innovative production processes.

One indication of greater focus on preparing students for the new production systems would be an increased emphasis on human resource management. The engineering based programs such as at Southern Tech still do not stress this--Southern Tech offers one course in Labor Relations. The apparel production management program at FIT does offer several courses entirely or partly devoted to human resource issues. The program offers both a course in personnel administration and labor relations and one in industrial organization and management. The production management and analysis course covers issues in operator recruitment and training. FIT's program also tries to give students who will not be involved in manufacturing some sense of the problems that factory managers must face. Thus marketing majors can take a course in which they study the tension between consumer demand and manufacturing constraints, and design majors are also given a background in production techniques including labor management issues. This type of cross-fertilization between designers, marketers, and manufacturers will become increasingly important in more flexible and integrated production systems.

But despite this impressive menu of options, most of these are not required courses. The implications of the latest developments in human resource management and training in the industry are only beginning to work their way into the curriculum. It is fair to say that educators have not developed a strong consensus of what it means to train a manager for a flexible manufacturing environment.

The education of mechanics is less well developed. Graduates of post secondary institutions are in general not interested in taking a factory floor job in an apparel plant. As the director of the Southern Tech program said, "graduates of my two year apparel program would see ending up in a mechanic's position as a failure to meet their expectations." Arrow tries to hire two year electrical engineering graduates for its sewing machine program, but has trouble finding enough. If employers want to hire community college graduates for technician jobs, they usually must send one of their own employees. To some extent, the industry itself is filling this gap by developing schools for sewing machine mechanics. In 1973, the Union Special Corporation started a mechanic's school in Illinois.[24]

The Arrow Company has a sewing machine mechanic school in Austel, Georgia. The managers try to recruit holders of two-year

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[24]For a description of the Union Special School see Santora 1987:108-9.

associate degrees in electrical engineering. They then send them to the training center for six months to learn sewing machine repair. After the first six months, the mechanics come back to the center frequently for small courses, and the training staff estimates that it takes about three years of this program to produce a fully competent sewing machine mechanic. Oxford Industries has also recently started a mechanics training center and takes in students from other firms as well.

These schools appear to train good mechanics, but the output is only a few dozen a year. Other firms have not opened training centers but have taken other steps to upgrade their mechanics. For example, Russell Corporation recently established a special position within the personnel department to oversee the hiring and training of the technical (machine repair) staff. Mechanics for the electronic equipment are sent out to a local community college to upgrade their skills.

Nevertheless, the preparation of mechanics is a weakness in the industry training system. Few young post-secondary graduates are interested in entering the occupation and upgrading programs are inadequate. Employers are continuing to make do with more informally trained mechanics. Given the increasing cost and complexity of the machines and the importance of machine reliability and speed of repair in a production setting with minimal inventories, this inadequacy is potentially a serious problem.

There are very few training programs for floor level supervisors in the industry. Supervisors are still drawn primarily from among experienced operators and receive little formal training. Firms that have installed unit production systems or modules or try to reduce inventories in other ways find the supervisors' jobs become more complex and sometimes more difficult. Strengthening supervisor training and improving upgrading programs to allow operators to move into supervisory positions should be a priority as the industry moves from a mass production emphasis to more flexible systems.

At the suggestion of the DLA, FIT is in the planning stages of a training program for supervisors. This would not be part of one of the regular degree programs, but rather a shorter term program possibly to be offered at the worksite. And the Oxford School also offers supervisor training courses. The most common supervisor training in the sample of firms that I visited involved short-term training conducted by consultants of between one and several days associated with various types of organizational innovations. When modules are introduced, supervisors (and operators and mechanics) attend training sessions where they are presumably taught to work in groups. The module orientation program at Russell lasted three days, and it lasted for 40 hours over a period of several weeks at Oxford. The Oxford School also offers a general training program, not only associated with the introduction of modules, that brings supervisors, mechanics, and operators together to help each better understand the functions and problems of the others and of the overall production process. According to the school's staff, this program is particularly well received by plant managers.

Formal training for operators outside of the factory is still rare. There are some secondary-school-level training programs in New York City that provide training for operators. There are a small number of very short term programs for disadvantaged participants. Two high schools in the city have special apparel programs--the High School of Fashion Industries and William Maxwell High School--and there are two proprietary schools that train students for apparel careers--Mayer School of Fashion Design and the Industrial Careers Institute. But the large majority of the graduates of these programs go into the design and marketing ends of the apparel industry. Industry representatives in the city believe that these and other programs produce a reasonable number of graduates in non-factory jobs such as designers and pattern and marker makers. The Maxwell High School is the only one that emphasizes entry-level manufacturing jobs, but the enrollment in the program has been falling for the last few years (Bailey and Waldinger 1987).

Only two of the factories I visited provided vestibule training for operators. One held the trainees in the program until they reached expected normal speed--usually about 13 weeks. In the other, the operators left the training center after five or six weeks. All of them did at least assign an experienced operator to oversee the training. The lack of a vestibule program did not seem to indicate a lack of commitment to training, but rather a reasonable conviction that it could be done best on the sewing room floor. Some of the most modern plants had no vestibule program. Nevertheless, if there is a widespread abandonment of the bundle system, it seems likely that it will be more difficult to put beginners into an operating module or unit production system, and more vestibule training will be required.

Certainly factory-based operator training could be strengthened. Operators will need to have more skills and a better understanding of the machines with which they work and the production processes of which they are a part. Perhaps the most serious problem with operator training is the low quality of secondary school education and the relatively low levels of high school completion. Most of the new skills and competencies called for in a product-oriented production setting will be much easier to impart if the operators have a strong secondary school preparation. A firm cannot adapt easily to changes in technology, work processes, and products if most of its labor force is illiterate. A very few firms have developed their own basic literacy programs or encourage workers to attend local public programs, but it is up to the public educational system to provide a solid foundation of basic skills. As a low-wage industry, apparel has a particularly important stake in a solid educational foundation for the entire population.

Conclusion

How ready is the system of training and education in the industry to prepare the apparel workforce for the new environment? Given the fundamental changes taking place in the industry, there must also be a corresponding change in management training. Without the enthusiastic commitment of the industry's leadership, the changes will be limited and superficial. The post-secondary textile and apparel schools are well connected to the industry and at least have good access to information about industry needs. There may be some disagreement about how those schools can best prepare apparel managers and engineers for the emerging environment, but the institutional framework is in place to address these needs.

The role of general community colleges in preparing managers and technicians for the industry is much weaker. These schools lack the strong contacts with the industry and do not tend to attract students who start out with an interest in apparel. Thus, for example, it is difficult to attract electrical engineering associate degree students to a traditional manufacturing industry such as apparel. Especially in the south, these students often go to community colleges precisely to avoid a job in the mills. As a result, training for the middle level occupations--positions needing a high school education with some additional technical training--is problematic. The weakness seems to result from a lack of appreciation of the importance of these jobs on the part of employers, a lack of interest on the part of students, and poor quality and insufficient capacity in the education system.

The preparation for entry-level occupations must rely primarily on the outside educational system. The potential problem here is that so many of the industry's lower level workers have weak basic skills. In the past, industry managers have viewed low educational levels as an asset to the apparel labor force--if apparel workers did not need a secondary school education, then high school degrees would just increase their expectations. But to the extent that apparel firms face a more rapidly changing environment, they need workers at all levels who are adaptable. And solid general education helps individuals adjust to change.

Finally, much of the educational challenge facing the industry in the future will involve training and retraining adult workers and current employees. Continuing changes in technology, products, market characteristics, firm organization, and production processes will require more frequent retraining and updating of knowledge. Informal training has always been an integral part of workplace education, but informal training is primarily useful for passing on knowledge from one group of employees to another. More explicit and organized means are needed for diffusing more rapidly changing skills. Moreover, if experienced lower level employees continue to be the primary source of mechanics and supervisors, retraining and upgrading will be the key to the effectiveness of these increasingly important and demanding positions.

Improved continuing education can be carried out through a mix of local junior and senior colleges and technical schools, equipment manufacturers, training vendors, consultants, and internal training departments. Two large questions remain open. The first involves the content of continuing education--for example, the mix between conceptual and practical preparation, methods for increasing interaction among workers in different occupations, the development of teamwork and so forth. The second involves training in the smaller firms which constitute the large majority of apparel manufacturing establishments. While the institutional framework for continuing education may be in place for the largest firms, it is much less effective for small firms.

Chapter 7

Conclusions and Recommendations

The apparel industry thrived for many years using a traditional approach to manufacturing that emphasized cost cutting through reduction of direct labor costs. These costs could be cut both by maintaining low wages, seeking out regions with reserve pools of labor, and rationalizing the production process by breaking it down into many small tasks and then engineering each task separately. For decades, production technology hardly changed. Growing competition from imports in the late 1960s and 1970s generated a response that consisted of further reductions in the relative earnings of apparel workers and some developments in hard automation. This constituted a classic attempt to deskill the work process and turn workers into unskilled machine tenders. But there were serious technological limits to automation and most of the automation that was developed was inflexible or expensive. Thus, the strategy based on deskilling and automation was effective only for high volume makers of standardized goods. Market changes in the 1980s further weakened this strategy by reducing the market share for commodity apparel.

Apparel firms have now begun to move away from an exclusive focus on cost cutting and to concentrate on competing on the basis of flexibility, quality, innovation, fast turnaround time, and greater interaction with customers and suppliers. These new systems certainly involve advanced technology, but they also require major changes in personnel and training policy. Cross training, broader skills, a stronger conceptual understanding of work processes and business operations, increased ability to interact with other employees, and greater scope of action and responsibility among production workers all play a part in the new human resource strategy.

The apparel case has interesting implications for the controversy about the relationship between skills, technology and other economic changes. An analysis of skills and training in the apparel industry in the early 1980s would have provided support for the deskilling hypothesis. More recent events have not shown that the deskilling argument is necessarily incorrect, but that it applies to a specific historical era of the industry that was characterized by a particular combination of technological development and market and labor supply conditions.[25] For apparel manufacturing in general, those conditions are passing.

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[25] Patricia Flynn (1988) has developed a theory based on a technological life-cycle. Skill requirements change over the life-cycle of a given technology or process, and since there are always technologies at different stages of their cycle, skill requirements will be rising and falling in different sectors of the economy at any given time. Without denying the importance of cycles for particular technologies, I am emphasizing a broader historical trend toward greater change and uncertainty that affects the entire economy although its effects will be stronger or come more quickly in some sectors than in others.

Recommendations

The system for training and preparing the apparel workforce that has evolved over the last several decades was attuned to the conditions in the industry during that era. As I argued in the previous chapter, given the changes in technology, markets, and labor supply that have taken place in the last 15 years, that education system has serious weaknesses. The following steps would strengthen the system's capability for preparing the industry's labor force for a more flexible production system.

Training for management and higher level technical personnel: Management training is critical since no fundamental change in the operation of the industry can take place without the commitment of the leadership. The industry is already served by a network of post-secondary institutions that can promote change in the industry by the way that they prepare managers, designers, marketers, and upper-level technicians. But as they are currently designed, these programs need to focus more on the manufacturing process and particularly on the human resources functions. In general there should be a greater emphasis on coordination between training, engineering, human resources, design, and marketing.

Centers for the development and demonstration of technology and organizational innovation: Many of the changes that the industry needs involve the application and customization of technologies and organizational innovations that have already been developed. This creates an important role for demonstration and development (as opposed to research) centers such as the (TC)^2 headquarters in Raleigh and the projects set up by the Defense Logistics Agency both for technological diffusion and for the continuing education of the industry's managers and workers. Community colleges can also serve this function. These centers are programs particularly important for small firms.

Training for middle level personnel: Middle level personnel such as front-line supervisors and technicians play critical and demanding roles in a more rapidly changing environment. Nevertheless, even now, little formal training exists for these workers. This may be one of the greatest deficiencies of the overall system of apparel education. Public sector educational institutions, private sector training providers, and larger apparel firms should develop stronger programs to prepare these middle level personnel. Particular emphasis should be put on programs to upgrade lower level workers for these positions.

Basic skills: Basic skills have become increasingly important in the industry. This research suggests that there is a relationship between a firm's emphasis on training and education and its ability to introduce modern technology and organizational innovations. More education has also been shown to promote adaptability. A basic secondary school education is a reasonable foundation for the industry's labor force. Since in many areas the apparel industry is still an important force, large employers or employer ass[illegible]ations have a unique opportunity to work with the local secondary schools to improve the basic skills of the local labor force.

Upgrading for immigrant workers: In many areas, it is increasingly difficult to find highly skilled tailors and sewing machine operators. On the other hand, immigrant-owned firms that are primarily in lower-skilled sectors of the industry can still tap a local immigrant workforce. Programs designed to train these lower-level immigrant workers for the skilled jobs and to help them find jobs outside of the immigrant sector would be in the interest of the industry and would also open better employment opportunities for these workers.[26]

On-the-job training: Training carried out or funded by firms and retraining of experienced workers must also be strengthened. There is already in place an institutional framework for continuing education. This includes local junior and senior colleges and technical schools, equipment manufacturers, training vendors, consultants, and internal training departments. There are two broad reasons why on-the-job training needs to be strengthened.

First, one of the industry's important contributions is that it provides employment for many workers with low levels of education and skills. Indeed this employment function is a fundamental political justification for tariffs and other import restrictions for apparel. If the industry is to continue to play this particular employment role despite rising skill

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[26]This recommendation is discussed in detail in Bailey and Waldinger 1987.

requirements, then the gap must be filled by training and upgrading of experienced workers. Moreover, many apparel makers may not have the choice of using more educated workers since they already have trouble finding such recruits. On-the-job training also tends to reduce turnover and reducing turnover eases the pressure on recruitment--if workers do not leave, new recruits do not need to be found to replace them.

To the extent that the industry is expected to play a broader social function through training, there is some justification for giving assistance to firms, especially small firms, for providing that training. Already a small number of apparel firms take advantage of federally financed programs to teach their workers basic skills. Funds for upgrading may also be available in some areas from the Job Training Partnership Act. Training provided by local community colleges is partly subsidized since tuition never covers the full cost of the education. The unions in the industry and employer associations might also sponsor some training. This has the advantage of spreading the cost of the training so that individual employers will not lose their investment in a worker's training if that worker leaves.

The second broad reason why firms must put more emphasis on training and upgrading their experienced workforce is purely economic. As the pace of technological and market change quickens, skills and knowledge will become obsolete more quickly. Formal training will be necessary to guarantee that workers keep up with the latest technologies. It is just as important that the training be organized to facilitate continuous adaptation to changing technology and products.

Increased on-the-job training could also be combined with efforts to promote both process and product innovation. For example, the training programs that teach operators, technicians, and supervisors to work with a new technology could also be a source of ideas about the most efficient way to use that new technology within the particular context of the firm. And if those receiving the training include sales, marketing, or design personnel, then the training process could also be used to promote product innovation.

Comprehensive training programs to promote flexible production in the apparel industry are still new and have not been subjected to rigorous evaluation. Nevertheless, firms are trying a variety of approaches that seem promising. For example, in addition to training specific skills, some training efforts try to impart to workers a basic understanding of the fundamentals of both the overall production process and the business of the firm. The content and organization of the training in some cases is designed to foster communication and interaction among workers at different levels of the employment hierarchy and in different departments. This is based on the concept that if production is increasingly a group or joint activity, then training should follow suit. Training that brings together workers from a variety of positions not only broadens the individual worker's knowledge of the operations of the firm, but improves the direct communications among departments that is important for flexible production processes.

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In the past, employers in the industry have seen a direct conflict between improving apparel jobs and the firm's bottom line. Firms competed by driving down their costs, but making jobs more attractive required raising wages which increased costs. The new realities of the output and labor markets both doom this approach and offer a way out. Cost is no longer the king of competition. Faster throughput time, greater flexibility, better and more interactive relations with customers and suppliers, improved service, and innovations in design and manufacturing processes have all increased in importance. Deskilling and labor cost cutting will continue to be in the interests of apparel makers in some sectors of the industry. But those will be shrinking sectors.

Meeting the new demands will require changes in work design; changes in training; and changes in relationships between supervisors and production workers, among production workers, and among firms in the supply chain. These changes, called for by developments in the markets for apparel, can also be used to improve the jobs of apparel workers. Thus apparel makers must begin to take a much broader and more imaginative look at the employment process and search for ways in which they can restructure jobs that will both strengthen their firms' positions and make the jobs more attractive. It remains to be seen whether such policies will be enough both to attract and prepare an adequate labor force and to maintain the industry's international competitiveness. But without them, over the long term, garment production in this country can only continue the decline that has already cost over two hundred thousand apparel jobs in the last decade.

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