The Spatial Division of Labor: Labor and the Location of Industries

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Location theory has long been dominated by the precepts of neoclassical economics. That situation has been changing in recent years as more and more of the mainstays of the neoclassical approach to the location of industries have come under fire (Storper, 1981; Walker and Storper, 1981; Walker, 1982). One of the most glaring shortcomings of the traditional approach has been the treatment of labor as just another "factor of production" of little importance to location outside of a few labor-intensive industries. The purpose of this essay is to enrich this impoverished view of labor and in so doing push the "labor factor" to the forefront in the analysis of the modern geography of industrial capitalism.

It is readily apparent to rubber workers that closures of tire plants in Akron at the same time new factories have been constructed in the open shop states of the Sunbelt has had something to do with union contract demands on the industry. The movement of electronic assembly plants to Asia also seems to be based on the almost ten-to-one wage ratio between there and the United States. But attempts to explain industrial shifts in terms of a labor factor measured only by wages and unionization rates have not proved entirely successful. Why, for example, has all manufacturing not been relocated abroad if wages are so much cheaper? Perhaps other cost considerations outweigh labor in determining location patterns, as some large regression studies have
purportedly shown. Or perhaps the wrong things have been measured by both those who believe labor is the critical variable and those who do not.

In order to appreciate the role that labor plays in location, it is necessary to rethink quite thoroughly the conventional (neoclassical) notion of labor as a “commodity” possessing certain fixed qualities (skills), exchanged in “labor markets” for a wage, and utilized by industry in such a way as to optimize its “marginal product.” To this end we must dissect the labor factor with care, inquiring into such matters as the changing context of global production; the noncommodity character of labor; its geographic availability; the distinctive technological demands on labor in different industries; the functioning of labor markets; the participation of labor in production and labor relations in the workplace; and the contradictory character of employment. We can then reconsider industrial location as a managerial strategy for dealing with labor; the interaction of employment and location over time; and the resulting spatial division of labor.

GLOBAL CAPITALISM AND THE DIMINISHING IMPORTANCE OF NONLABOR FACTORS IN LOCATION

For an increasing proportion of industrial commodities, markets, production, and competition have become worldwide (Caves, 1980; Barnet and Muller, 1974; Frobel et al., 1980; Palloix, 1975; Mandel, 1975). This globalization of capitalist industry has wrought fundamental changes in the circumstances facing a company deciding where to build a plant. A much broader choice of potential sites has been opened up where the basic conditions for profitable production may be met. The modern corporation engages in what Raymond Vernon (1977) refers to as a “global scan” for investment opportunities. This reduction in cost and revenue differentials among industrial sites applies principally to the realm of industrially produced goods, diminishing the locational force of non-labor factors. The principal sources of what may be called the increased “locational capability” of capital today are the following developments in circulation, production, and organization:

Circulation: Transportation and communication improvements have lowered the costs and time of circulation, bringing a wider geographic market within the range of any industrial plant. (Technical progress has simultaneously reduced the weight of most products.)
Probably the best-developed example of the above tendencies in a single industry is automobiles. Autos are now sold in virtually every country, and captive national markets are rapidly breaking down in the face of what is essentially global competition. The product is becoming more standardized, led by the so-called world car design. The producers are all giant multinational corporations which, like Ford Motors, may earn more outside their country of origin than within it. Production systems are global with, for example, one company having an axle plant in Spain, an engine plant in Mexico, a transmission plant in the southern United States, and so forth. These parts are brought together in assembly plants which no longer simply serve local markets but assemble particular models for widespread distribution. As a result, the industry has complex and shifting cross-linkages in the movement of materials, trade of the final product, andorganizational ties. Textiles, in contrast, are still produced in single processing factories instead of far-flung parts and assembly systems. Trade and competition are essentially global, nonetheless, and competitive advantage has shifted back and forth between nations.

Of course, locational capability is not equal across all industries. The “global scan” is more a tendency than an accomplished fact. In general, however, locational differences in the availability, cost, and quality of nonlabor commodities are diminishing, a vastly larger number of suitable sites are available to industry, and production systems are becoming more dispersed across the nation and around the globe. These developments have not simply freed plants to be located anywhere businessmen please. Rather, they have made it more important than ever that corporate executives focus in on the labor factor as the key to locational competitive advantage.

THE UNIQUE CHARACTER OF LABOR

With the trend toward globalism, labor steps to the forefront because of its continuing high degree of spatial differentiation. Labor’s persistent geographic distinctiveness originates in its unique nature as a “factor of production.” Labor differs fundamentally from real commodities because it is embodied in living, conscious human beings and because human activity (work) is the irreducible essence of social production and social life (Marx, 1967; Gintis and Bowles, 1981). While this may appear obvious, its significance has been lost on generations of neoclassical economists and location theorists, who have persisted in treating labor in the same terms as real commodity inputs and outputs, that is, reducible to price (wages) and quality (skills).

True commodities can be industrially produced, purchased at a consistent price and standard quality, owned outright, and employed in a strictly technical manner, however and whenever the owner wishes. (This is somewhat less true for plants and animals than inanimate objects.) Their purchase and use can thus approach a standard of performance versus cost, and they are susceptible to a geographic leveling process, as just indicated. Labor, in contrast, remains idiosyncratic and place-bound because none of these conditions hold.

Four dimensions of the pseudo-commodity labor can be distinguished: conditions of purchase, performance capacity, actual performance (control), and reproduction in place.

Conditions of purchase: Labor is purchased on the market, but the capitalist buys only the right to employ the worker for a limited period of time; one does not buy the worker outright, like a slave. The conditions of purchase for labor entail, besides wages, such things as safety and health, security and regularity of employment, prospects for advancement and fringe benefits, and so forth. Such considerations never enter the picture where true commodities, such as forklifts, are concerned; but they often matter more than wages to workers.

Performance capacity: In determining the cost per unit output of a commodity, the purchase price must be weighed against performance, or use-value. But the pseudo-commodity, labor, presents two difficulties as soon as we look more closely. First, performance is a multidimensional and very human capacity which includes technical skill, intensity, adaptability, discipline, sociability, self-direction, stability, and the like. The way in which a worker must apply his or her mind and body to the essentially creative process of work cannot be reduced to a technical formula as can the capabilities of a drill press.

Labor control and actual performance: The second difficulty in measuring the performance of labor is that you do not always get what you pay for. Performance capacity is not the same as actual performance because of the worker’s ability consciously to limit his or her mental and physical effort. Workers, unlike computers, must willingly engage their capacity for work and have the power to resist their use and exploitation by the capitalist. The level of intensity, continuity, and quality of work that can be elicited from workers, and with what degree of supervision, monitoring, and punishment, is of fundamental importance to the employer. The usual term for the problem of elicit-
ing performance is labor control. Control is perhaps a misleading word
since it is not enough that the workers follow the employer's orders;
they must actively participate in production and their own exploita-
tion. Capitalist production contains a fundamental contradiction be-
tween the need for labor control and the need for thinking, capable
working people.

Reproduction: The performance capacity, degree of compliance,
and purchase price of labor are socially produced. Because workers,
unlike true commodities, are free to leave the plant at the day's end, a
substantial part of labor's (re)production takes place in the home and
community. In other words, workers cannot be industrially produced as
are true commodities. Therefore, labor has no objective cost or quality
but varies as widely as human culture allows. Chemical workers in
Bayonne, New Jersey, and Port Arthur, Texas, are very different peo-
ple, while the chemicals they produce are indistinguishable.

LABOR SUPPLY DIFFERENCES IN SPACE

The four dimensions of labor just defined form the basis for geographic
variations in the supply of labor. Reproduction in place-bound com-
unities is the starting point. A measure of stability is necessary for,
and demanded by, workers for their sanity, nurture, and happiness.
More is needed where children are concerned. It takes time and spatial
propinquity for personal support systems to evolve out of the chance
contacts of daily life. Much longer is needed for the central institu-
tions of working-class life—family, church, clubs, schools, language (dia-
lect), sports teams, union locals—to take shape. These outline the flux
of individual migrations to benefit and be sustained by generations.
The result is a fabric of distinctive, lasting local “cultures” woven into
the landscape of labor, even in the highly mobile environment of the
American working class (Fischer, 1976; Warren, 1978; Timms, 1971).

Living standards, militance, work experience, skills, educational
levels, and the like thus vary markedly between locales. First, as
regards “conditions of purchase,” wage differentials are still substantial
in the United States, and such things as occupational safety and health
standards vary even more (USBEA, 1978). The performance capacity
of various work forces also differs markedly among regions (Scoville,
1973). In Britain, for instance, the main pools of skilled manufactur-
ing labor are found in the cities of the Midlands, office professionals
are found in London, miners in South Wales, academics in Oxbridge,

and so forth. Despite its exclusion from traditional location theory, the
central aspect of labor supply has been shown by empirical research
to be a basic consideration in location decisions because of wide vari-
actions among labor force in levels of absenteeism, turnover, sabotage,
union organization, and other forms of militance.

INTRODUCTION TO LABOR DEMAND

The hypothesis that labor is critical to industrial location rests on the
continuing differentiation of labor demand as well as supply, if indus-
tries are to seek out different locales systematically. At its most ele-
mental, the demand for labor rests on three conditions:4

1. Workers must carry out certain tasks at an adequate level of
   performance. This requires a consideration of the labor process
   and production relations.

2. Work must be compensated at a rate that will attract a sufficient
   number of laborers. This requires consideration of the labor
   exchange.

3. Unit labor costs must be consistent with the economic survival
   of the firm or workplace under competitive conditions. We must
   narrow this to consider only the bounds put on production and
   the labor exchange by the character of particular sectors.5

These skeletal elements of employment and job content must now be
filled out.

INDUSTRIES: SECTORAL DIVERGENCE
AND PRODUCT TECHNOLOGY

In an era in which aggregate statistical analysis is all the rage in eco-
nomics and diversified corporations freely cross traditional sectoral
lines, a call for “industry case studies” has an antiquarian ring to it.
Even most Marxist thinkers are prone to emphasize the common forces
set in motion by capitalist production relations, such as “labor deskil-
ling” and “centralization of capital,” which cut across industries and
cause them to converge in their development. But it is important not
to confuse the abstraction of underlying, “structural” tendencies with
empirical generalization; that is, the same forces acting on different
branches of industry may result in quite distinct outcomes, depending
on the specific conditions in each sector. Aggregation can hide as much as it reveals.

The importance of disaggregation was borne out in our research into four industries: microprocessors, cotton textiles, aircraft engines, and auto engines. Many industrial geographers hold to the position that industry has become quite universal in its distribution, unlike past concentrations of sectors as steel in Pittsburgh or garments in New York City. We found, however, that wide dispersion was often a statistical illusion of aggregation. For example, “textiles” are found up and down the east coast, but carpets are almost entirely produced in Georgia, cotton cloth in North Carolina, draperies and woolens in New England. The “electronics” industry is similarly dispersed until one looks closer. Semiconductor wafer fabrication is still almost entirely concentrated in Silicon Valley (Santa Clara County), with some satellite areas opening up around California. Semiconductor assembly, on the other hand, has largely moved out of Silicon Valley to Southeast Asia (chiefly Singapore), the Mexican border, and select spots in Texas, Oregon, Idaho, and Colorado. Mainframe computers, which use the microchips, are concentrated almost wholly in Santa Clara County and Route 128 around Boston. Capacitors and resistors, in contrast, are produced mainly in Pennsylvania and New Jersey.

How do we account for such persistent specialization even in the newest sectors? If industries converged, their materials, labor, and marketing needs would be similar, and locational disparities would then have purely idiosyncratic origins. While the element of chance cannot be ignored, an entirely better starting point for an explanation of locational patterns is the obvious differences in the specific physical and social properties of products to be produced, transported, and consumed. The common forces of competition, class struggle, and concentration of capital have led industries down different evolutionary paths because each product sector faces fundamentally different sets of possibilities and limits in marketing, production technology, and organization (Scherer, 1970; Bain, 1966).

Market sizes and growth rates depend on product uses, adaptability, substitutes, durability, innovation, and the like. For example, petrochemicals spawn new variants with new uses by the thousand each year while shoes can change only slightly in style and little in function. Different products also have substantially different production methods with widely divergent potentials for standardization, mechanization, and automation. The kind of continuous flow, automated processing possible in chemicals can only be dreamt of by the
garment industry. Market characteristics and production processes are, in turn, essential determinants of the competitive structure of the industry. For example, the massive costs of setting up assembly lines and a distribution network have been a major barrier to entry in the auto industry, making this long the epitome of an oligopolistic industry. Airplane engines are a large, sophisticated, precision product with limited markets among a few captive buyers; this too presents a barrier to competition. Market fluctuations make profits highly volatile, however. Cotton textiles, on the other hand, are standardized and mass produced, like cars, but machinery costs and distribution problems are much less, so competition is strong and profits low.

All three conditions—markets, production technology, and sector organization—may feed on each other in cumulative fashion, so as to propel an industry further along a particular growth path. For example, because textiles cannot be automated much more at this time and the markets are large relative to any one factory’s output, there is a continual opening for new competitors entering the field; hence the industry has a low level of concentration which, coupled with steady but unspectacular sales growth, translates into modest profits; these in turn deny it access to financial resources that might be used to spur innovation. In semiconductors, on the other hand, high growth rates and low entry barriers attract new capital and encourage technical innovators to go into business for themselves, whereupon their new products further revolutionize the industry, opening up more markets, continued rapid growth, and so on.

Because sectoral conditions are closely bound to the peculiarities of products, the deal that can be struck with labor in the workplace and in the labor exchange is necessarily limited. Firms can only go so far in their rapprochement with labor and still meet the competition. Thus, industries offer distinctive economic possibilities for creating jobs that are stable or unstable; high or low wage; high or moderate in pacing; dead end or offering advancement; and so on. (We will consider employment conditions in six industry types below.)

THE LABOR EXCHANGE AND SEGMENTED LABOR MARKETS

In neoclassical economics fair exchange of equal for equal is the rule, whether it takes place in the market for cabbages or in the market for labor. Thus labor economics, particularly “human capital” theory, ar-
gues that workers are paid according to their value in production, whether measured by skills, effort, or scarcity value (cost or time of training). Empirical studies, however, have not borne out conventional expectations as to the operation of the labor market. Rewards—including wages, work conditions, stability, advancement, and autonomy—are not consistent with the performance capacity of workers in particular jobs. Rather, there are systematic industry and occupation-specific differences in rewards even when one corrects for skill, training time or cost, and effort. Overall, the spread of wages and conditions is much wider than the spread of performance capacity, and workers are divided into hierarchical “segments” between which there is relatively little movement (Doeringer and Piore, 1971; Edwards, Reich, and Gordon, 1975).

A typical representation of labor market segmentation is the following:

1. An “independent primary” segment features jobs with high wages and full-time and full-year employment, with work usually self-directed or self-controlled. The worker is relatively autonomous and a considerable amount of social status is attached to the occupation. Professionals and skilled craft workers fall into this category.

2. A “subordinate primary” segment sports relatively high wages and full-time and full-year employment. But work is not self-directed, and workers face occasional layoffs and limited mobility prospects. The better manufacturing jobs fall into this segment, such as in petrochemicals or automobile assembly.

3. The “secondary” labor market has low- to moderate-wage jobs, where the typically unskilled worker faces the possibility of several unpleasant circumstances: limited mobility; overt social control on the job; instability; and physical discomfort. An increasing proportion of production and service jobs fall into this category, as in electronic assembly, garments, machine assembly, and banking.

One way of accounting for labor market segmentation is in terms of sectoral conditions. For example, a highly seasonal, technically unsophisticated industry such as canning utilizes a large secondary labor force, usually minority women, to meet summer and fall peak production. But sectoral conditions do not adequately explain conditions of employment by themselves (Dunlop, 1962; Freedman, 1976).

We must therefore introduce a degree of freedom into the labor exchange. Labor and capital can bargain over the distribution of income, within the context set by the nature of the product sector. Given the possibility of bargaining and the pursuit of advantage by each side, one can see that it is in the employer’s interest (and often in the interest of favored workers as well) to segment opportunities and discriminate among workers. If women or blacks can be paid less for doing the same job a white man would do, profits can be increased. The evidence for systematic discrimination based on such crude background characteristics as race, sex, and ethnicity is ample (Reich, 1981; Edwards, Reich, and Gordon, 1975).

But employers do not have all the bargaining chips. Otherwise, we would not find such instances of unexpectedly high rewards as complete recreational facilities in some Silicon Valley electronics plants or the high wage and benefit scale of semiskilled automobile workers in Detroit. These cannot be explained simply by the scarcity of particular types of labor. To discover the sources of worker leverage in dealing with employers, we need to delve into the labor process, going beyond mere conditions of exchange—what is paid and what abilities are purchased—to actual performance and worker control on the job. At the same time, the idea of conflict and bargaining must be extended to the terms of the job itself.

LABOR PROCESS AND PRODUCTION RELATIONS

Production rests on an objective basis in the sense that certain operations must be performed on natural materials to produce a particular product. This poses a problem which must be solved through a definite “technology,” or organized system of human tasks (detail division of labor), tools (machinery), and natural processes. But the strict objectivity of production ends at the engineer’s design table. Machines never run entirely by themselves; they require the constant intervention of workers, who internalize technology in their personal knowledge and activity. Workers remain necessary to all production, no matter how sophisticated and automatic it is, if for no other reason than to deal creatively with the inevitable failures of machines and materials (Burawoy, 1979; Pfeffer, 1979).* The designers of the Bay Area Rapid Transit System (BART) in San Francisco found this out to their regret when they tried to produce a subway system without human operators in the trains or the stations. It did not work, and operators
had to be put back in. Even the most nominally “unskilled” jobs still require constant problem solving, although the tasks may be chiefly “manual.” If they did not, a machine would be used instead.

Because all workers retain an essential measure of control over the conception and execution of work, their active cooperation in the labor process is required (Aronowitz, 1978; Burawoy, 1979; Gordon, 1980). Managers must come to terms with workers if anything is to be accomplished. This gives workers a basis for leverage in bargaining above and beyond their mere scarcity value in the market. Conversely, workers need employment in order to survive and to have the opportunity to exercise their creative powers. Employers and workers are each other’s captives in the workplace; their relationship is characterized by mutual interdependency.

Technology incorporates the workers and social relations in another way: production is always a collective process, involving communication, physical interaction, and group effort. Materials may have to be moved to and from work stations, as in machining; workers may be linked in a sequential work process, as in automobile assembly; groups of workers may come together to assemble a large item, as in aircraft assembly; machine operators need to communicate and coordinate functions, as in petrochemicals; or workers may simply be confined together in a small space, as in garment factories. Such social interaction is based on the specific patterns of technical interdependency in each industry. The quality of the interaction varies, moreover, depending on such things as work pace, noise, the need for mutual aid, and conjunction of work goals. Even nonworktime socializing in lunchrooms or bars will be affected by the opportunities provided by shift schedules, common experiences at work, and exhaustion. Social interaction, it must be emphasized, frequently involves as much creativity and problem solving as individual work tasks.

The combined result of the individual and collective activity of work is not only the production of commodities. Workers create a social life, from which collective strength may be drawn, and a social consciousness, from which a sense of worth and opposition to the employers may arise. Industrial sociologists have frequently pointed out that the organization of work—job autonomy, worker interaction, group segmentation, and so forth—powerfully influences whether workers come to understand the employer’s dependence on them and translate this into demands for higher rewards (Burawoy, 1979; Gordon, 1980). Thus, worker militance like individual skill requirements, rests on the

Textiles and auto assembly both involve mechanized, routine, semiskilled labor, yet workers in the latter are more often unionized and better paid. Their greater militance rests in part on the distinctive organization of work which helps generate solidarity: the common status of the workers, the common pace of the assembly line (which it is in everyone’s interest to slow down), stationary positions from which it is possible to talk to others nearby, frequently close coordination of several tasks, and the common practice of helping out the next worker in the line. In textile factories, on the other hand, workers are divided by the extreme noise, higher work pace, shifting work position (moving among machines), and competition among workers with tasks having very different pacing. As a result, the work force is sharply segmented along the distinctions between tasks: weavers, machine fixers, doffers, and slashers (not to mention the wholly separate work groups in carding and dyeing). Not surprisingly, racism and sexism are rampant (Burawoy, 1979; Pfeffer, 1979). Similarly divisive relations have been reported for machining and paper cup production. Conversely, long-shoring before the age of the container ships involved gang work with a great deal of mutual aid, on which strong feelings of solidarity have been built (Mills, 1979).

Given the potential power of workers over production and leverage in bargaining, employers must create (or take advantage of) counteracting means of control. These occur both within and outside production, mediated by the labor exchange. The former include the personal power of the foreman, bureaucratic regulation and reward systems, and the reorganization of work (technical control), as described by Edwards (1979), as well as union cooptation, internal labor market segmentation, work pace, absence of breaks, specific antisocializing rules (such as no talking), and the like. At the same time, some of the strongest means of control lie outside the workplace, in the condition of the labor force hired, such as race, sex, excess supply, and lack of other job opportunities. For example, electronics assembly factories tend to hire only young women, who are notoriously exploitable because of patriarchal socialization and familial obligations. The exchange bargain can also be used for labor control, by paying workers more than they can get in alternative local employment, in comparable jobs elsewhere, or through unionization. Managerial control mechanisms fundamentally modify the kinds of social relations that might otherwise arise in the workplace and even affect the technologies on which production is based.10

One should not see “control” simply as the result of direct em-
ployer interventions, however. The nature of the production problem plays its role. More important, so do the workers. Workers and managers together participate in social worlds in miniature in the workplace which no one creates by direct intention. Capitalists and laborers become so ensnared in these relations, or social “games,” that the class nature of production and sometimes even the productive goal itself may be lost from sight (Burawoy, 1979). Ironically, then, workers often energetically cooperate in their own exploitation.

In short, the social relations of the workplace, or what Burawoy (1981) calls “relations-in-production,” mediate the effect of objective tasks and task systems on worker performance and job rewards.

**THE EMPLOYMENT RELATION AND ITS CONTRADICTORY DEMANDS**

Production relations and the labor exchange together constitute the “employment relation” between labor and capital. Here the two classes come together in a way that is at once a market transaction, a labor process, a site of struggle, and a scene of daily life. The employment relation is a site both of conflict and cooperation. Employers and workers are captives of each other and of the production project they must carry out. Neither side is free to get all it wants from the employment bargain, though the capitalists are in a dominant position. Labor depends on capital to invest, purchase the means of production, and set production in motion; its demands must be within the limits set by the successful reproduction of the unit of capital (firm, factory) on which it depends. If the outcome of the employment bargain in terms of productivity, technical progress, and general managerial control is too favorable to labor, the firm or the sector will fade from the scene.

Conversely, capitalists need workers who will participate actively in the labor process, perform at a level of proficiency, and settle for rewards sufficient to create a profit while returning another day to work again; they are limited in their demands by the standards of work and living conditions labor can and will tolerate. Both together must successfully produce a saleable product.

Within these bounds, a variety of technical, economic, and social outcomes are possible. “Labor demand” is therefore not a given set of jobs with set skills and rewards, determined by either technology or the pure logic of the capitalist economy. It is, rather, the indeterminate result of human agency, including individual decisions and group social relations in the workplace and in the labor exchange. But the technical possibilities of the product, the economic conditions of the sector (and firm), and the commanding power of the capitalist give it shape.

Employment in capitalist industry necessarily contains a contradiction between worker cooperation and worker control. Management must keep rewards within the bounds of profitability, productivity, and technology in line with competitors, and it must keep general managerial prerogatives intact. But it must do so without suppressing performance too greatly. Employers therefore “demand” a labor force that can perform the tasks involved in producing useful commodities without unduly exercising its subjective powers to make its own demands for rewards, work conditions, and control over working lives. Firms must continually secure a labor supply that confines the contradiction between cooperation and control in employment relations within the economic bounds of the sector.

If, for example, the firm’s competitive status depends on product quality or reliable delivery, as in the computer industry, concessions in areas of worker-employer antagonism are required to secure satisfactory task performance. These concessions affect both rewards in the labor exchange and work rules inside the factory. But if the employer has little or no latitude to make such concessions, and the product is standardized and/or technically unsophisticated, as in cotton textiles, worker bargaining power must be curbed. We must be sensitive, however, to the degree of freedom in labor demand despite apparently fixed production “requirements.” In southern California’s lemon industry, for example, the end of cheap bracero labor resulted in a drastic reorganization of work despite the absence of breakthroughs in mechanization. The harvest period was simply extended (lemons do not ripen all at once or overripen rapidly), and harvest workers were trained for nonharvest tasks, such as pruning. Furthermore, the switch to year-round employment, coupled with improved wages, secured the loyalty of workers against inroads by the United Farm Workers (De Janvry, LeVeen, and Runsten, 1980).

**SIX TYPES OF PRODUCTION PROCESSES AND LABOR DEMAND**

The fulcrum of employment in every industry is the production process. We have investigated six major types of industries, based on their production processes (Storper, 1982). These manifest distinctive labor demands representing different balances between performance (ca-
pacity plus cooperation) and control (in the workplace and through the labor exchange). These balances are bound, in turn, by sectoral conditions of competition and profit that are, as previously indicated, also strongly correlated with the nature of the product and production in that industry. The six production process types are classified in terms of their dominant technology, although all real production systems are composites of several discrete labor processes with varying specific technologies. Technologies can be characterized in two dimensions: conversion (action on the material) and transfer (movement of the material from one work process to another). The former can be rated on a scale from manual to machine-aided to fully automatic, and the latter on a scale from hand transfer to moving line to continuous flow. When known manufacturing technologies are plotted on these two axes, they cluster into nine discrete combinations, of which the following six are probably the most common. This scheme obviously simplifies both real production processes and the range of possible employment relations that may arise on the basis of any technology type. Nonetheless, it offers a helpful first approximation to the study of industrial labor demands that represents a significant advance over conventional alternative schemes such as capital-intensive versus labor-intensive industries, monopolistic versus competitive firms, or the tripartite labor market segmentation model.

1. Craft-type batch production: Production runs are short, and product is customized or changes frequently. Workers may come together in groups to work on a stationary, often large, product. The work requires high technical skills, as in machining or carpentry, and adaptability to changing tasks, although each production batch may be quite routine. Workers are in a strong bargaining position because of performance requirements, group work activity, and a strong sense of individual worth and occupational status. But management normally exercises effective control by promoting the divisive effects of job hierarchy and occupational status. Profits are higher the more customized the product, but the versatility of limited, specialized markets creates rather unstable conditions. Labor demand therefore emphasizes performance capacity more than control, and high wages if workers can tolerate employment instability. The aircraft and construction industries generally fit this type.

2. Continuous processing: Production is continuous flow and highly automated. Specific technical skills are needed less than general cognitive abilities, which are transformed into plant-specific skills through on-the-job training. Work is nonroutine and requires a high degree of responsibility, alertness, and adaptability to minimize down time and deal with unforeseen circumstances. Recruitment is chiefly by such generalized criteria as years of education. The high cost of production technology (combined with securing large continuous sources of raw materials and market outlets) forms a barrier to competition. Some measure of control is achieved through bureaucratic organization and labor market segmentation—ordinary construction and maintenance is often subcontracted to entirely different labor forces. But the principal mechanism of control is to give wages and working conditions better than would be expected for the level of skill involved. This is made possible by good profits and necessary by the need for worker cooperation and trust in protecting and fully exploiting huge capital investments. Petrochemicals and refining exemplify this type of production.

3. Automated processing: As in type 2 industries, workers must watch over delicate, integrated machine systems and are expected to minimize down time; they are "polyvalent" machine tenders. But because processing is not as completely machine-contained and automated, there are more workers required and jobs are more physical, work more routine, and conditions less attractive. Sectoral conditions also tend to be more competitive and less favorable for the exchange bargain, although relatively stable. Managerial control is based less on high wages than internal systems of bureaucratic evaluation and promotion. Labor demand emphasizes general performance characteristics rather than rewards or external control. Examples of this type of production are pulp and paper mills and standardized metalworking, such as ball-bearing manufacturing.

4. Mechanized assembly: Jobs in this kind of production process require generally modest technical skills. (The mean skill level lies between types 1 and 3 and types 5 and 6, but the variation is wide.) The work is maddeningly repetitive, and the pace can be hard, although it is more moderate than in industries 5 and 6. Because of strong task interdependency on the assembly line, management wants people who are steady at their work and in coming to work each day (absenteeism runs high). On the other hand, the same task relations tend to generate a cohesive and well-organized work force that can stop the entire production process. Stable demand and high entry barriers, similar to industry type 2, have traditionally protected profits, allowing some leeway in labor bargaining (though this is changing, as discussed below). The employment bargain of the last thirty years has therefore involved rewards higher than skills, or scarcity value, and a measure of power over work rules in exchange for greater worker
cooperation, enforced through collective bargaining and the unions. Home appliance and automobile assembly are typical of this type of production process.

5. Mechanized processing: Technology is less advanced than in the type 2 and 3 processing industries. Though the jobs may still involve running large machines, they require more manual setting up, feeding, and tending. Specific technical skills are quickly learned although the tasks often require considerable agility, concentration, or strength. There is some range of skills given the separateness of labor processes involved. Work is hard, the pace rapid, and the tasks repetitive. Because of the accessibility of the technology and markets to new entrants, competition is considerable, and profits leave little room for maneuver. Given the prospects of low pay and grueling work conditions, the jobs are not attractive. Turnover is likely to be high. The separability and disjunction of tasks form the basis for managerial control through internal labor market segmentation (which can be compounded by race and sex differences). Management therefore needs a labor force with a low standard of living, little tradition of independence, and few alternatives for employment. The textile industry is the exemplar of this sort of production.

6. Manual assembly: This type of production is similar to type 5 in its low job attractiveness. Work is relatively unskilled, repetitive, and fast-paced. It usually needs less strength than agility and patience. Because of low task interdependence, it does not even require particularly low turnover. Competition is high, wages poor, and employment likely to be unstable because of nonstandardized markets and low technical barriers to entry. In other words, any labor force willing to take these jobs is likely to come from marginal members of the working class, usually immigrants or women. Management is likely to enjoy a strong measure of control over such people. But there is a potential for solidarity in the sameness of all jobs and the common plight of workers. Therefore management tries to enforce the isolation of workers, given the individual nature of their tasks. Extreme workplace control is also needed to elicit the necessary hard work. Electronics assembly and garment work are examples of this type of production.

EMPLOYMENT IN SPACE: INDUSTRIAL LOCATION AS A MANAGERIAL STRATEGY

Industrial location plays a fundamental role in the social dynamics of capitalist development. This role derives above all from the inherent tension and instability of the employment relation. Employment must allow for the mutual participation of classes in production while at the same time preventing workers from using their power over production and their leverage over the exchange bargain to threaten capitalist reproduction. Location is one strategy among several available to management for overcoming the potential contradictions of employing human labor to make a profit. Others include internal systems of labor control, recruitment policies, and direct interventions in working-class communities (for example, the creation of company towns). Every industry and every firm has a particular “labor problem” it must solve. Location and relocation offer one vital avenue to a solution. We may imagine, for simplicity’s sake, that they have in their minds an “ideal” demand for labor to suit the particular needs of their industry, which they hope to match with a real labor force through a correct choice of location.12

As the labor problem varies among industries, so does the location problem. For example, if the production process tends to create cohesion among workers, management will be especially attuned to traditions of organized militancy in communities where it might locate a factory. If labor skills are the outstanding consideration, management will look to the work experience, education, or training level and complementary skilled-work opportunities in a labor market area. If low wages are the key issue, an area with a historically low standard of living will be attractive. Most often, location and choice of labor force will be a matter of juggling opposing considerations and hoping to find just the right mix in the local labor force.

Some examples are instructive. Their locations satisfy the labor-demand/employment-relations considerations previously outlined.

The jet engine industry (in type 1 production process, above) is located principally in southern New England, which has a long machining tradition, generating a supply of highly skilled metal tradesworkers. The area also fits the industry’s particular “control” problem, given a very unstable product demand. The industry so dominates the region that there are not enough other job opportunities to absorb workers when it goes into a downturn. Workers are faced with the prospect of moving or waiting for the next aircraft boom. The traditional social structure also reduces exits from the region. Workers are thus more stable and lower paid than one would expect for a similarly skilled labor force in a big city labor market.

The cotton textile industry (a type 5 production process) is located principally in North Carolina, drawing workers from captive
labor markets in rural areas and small towns that are socially traditional and economically marginal. These conditions have made for a particularly docile, stable, and modestly paid labor force. Alternative employment opportunities are nil, traditions of militance poor, standards of living low, and the people prone to division by racism and sexism. Lack of skills and education are not a problem.

Semiconductor plants (type 6) have been assembled in large numbers in Mexican border towns in the last decade. There they employ only women, also newly arrived in the burgeoning barrios of towns such as Juarez. These women are a highly captive work force in both the physical and social sense. They have no experience of resistance from prior industrial work or their gender training in a patriarchal society. They have no time or energy for resistance given long working hours, long journeys to work by bus, and familial obligations before and after work. They cannot afford to lose their jobs, given the lack of alternative employment and their role as principal wage earner in the family. Their families are poorly integrated into city life and services, further restricting their experience, sense of the possibilities, and class solidarity. And they are, on top of this, closely controlled at work. This is an ideal low-wage, unmilitant labor force (Christopherson, 1982).

TIME AND SPACE: LOCATION AND REPRODUCTION

Location is not, of course, simply a "strategy" in the hands of management, to be manipulated as it sees fit to find the perfect labor supply. Nor is it a one-time decision, in which a new plant is built and an "ideal" labor force sought out afresh. It is necessary to consider the process over time. It has, for instance, been frequently pointed out that relocation occurs chiefly through rechanneling investments, a continuous process in which plant openings and closings are only dramatic moments (Walker and Storper, 1981). Employment needs to be seen in a similar light. The "ideal" of labor demand in the mind of management is extinguished as soon as production begins and the real-life interplay of workers, management, and techniques is set in motion. Social relations in production are brought into being which have a life of their own that extends beyond the constant coming and going of individual workers and managers. Employment is not, therefore, a single act of confrontation, cooperation, or bargaining between labor and capital but an ongoing part of their existence. To reiterate, labor is not simply cabbages, which may be exchanged in a single act in a "marketplace"; it is the living substance of the labor process, embodied in a human life.

Breaking out of a static conception of employment means rethinking industrial location. Location is more than matching plant labor demands to appropriate labor forces scattered about the landscape. It is entwined in the reproduction of capital, labor, and the pattern of industrial geography.

Employment, location, and sectoral development: Employment opportunities are not derived from sectoral conditions and technology that are wholly determined by external forces. On the contrary, the ability of management to cope successfully with labor under particular existing sectoral conditions at any period, whether through location or another strategy, is fundamental to the subsequent development path of the sector, firm, or work unit. For example, the securing of a suitably captive labor force may stir further impetus for technological change, as in the case of many California agricultural crops during the bracero period. Social relations that elicit great cooperation from workers and thus prove functional to management in the short run may also involve pride of work or a sense of traditional ways of doing things that hamper management's ability to alter technology in the long run to stay competitive. Postwar collective bargaining has had just such an effect in many cases; on the one hand, it has been a great pacifier of labor militance, but on the other, it has created a welter of protective work rules that are difficult to modify in industries such as autos, agricultural machinery, and rubber. Conversely, an overly demanding work force may cut into the profits available for research and development or enforce work rules that hamper management's ability to introduce new forms of work organization.

Employment, location, and community development: Industry does not often confront precapitalist labor forces in the advanced capitalist countries. Working-class communities have been constituted through their interaction with industries in the past and are reproduced and re-shaped through their continuing encounter with capital (Anderson, 1971; Bott, 1971; Joyce, 1980). Employment is the most profound influence on most people's lives. It imparts occupational skills, social contacts, work discipline and militance, money for a certain standard of living, and the like. Coal-mining communities in South Wales are profoundly different from London stockbroker suburbs chiefly because of their disparate employment histories. Industrial history is written in the lives of a nation's peoples as clearly as in its legacy of factories,
railroads, or houses (Massey, 1978b). The mixing of industries in some regions and in many workers' lifetime experience complicates matters, of course. But that sort of "cosmopolitan" mix may be exactly the characteristic distinguishing one labor force from another. Baltimore, for example, is known for its variety of skilled laborers coming out of many small enterprises, rather than its specialization in one or two basic industries, as is Pittsburgh.

Employment stability and regional development: The stability of an area's industrial base and of its local labor force is of great significance in maintaining a compatible employment relation and in reproducing labor and capital successfully. It is not by chance that industries and communities so often grow, mature, and decline in tandem. Examples can be drawn from every age of industrial capitalism: the textile and shoe towns of New England; the Motor City, Detroit; the Steel City, Pittsburgh. One can find the same phenomenon occurring within labor submarkets of big metropolitan areas, as in the aircraft industry of the west side of the Los Angeles area or the electronics industry of the Santa Clara Valley (San Francisco Bay area).¹⁴ Employers understand the phenomenon of community stability and frequently seek to exploit it. A good example is the bitter resistance of some small town Southern firms enjoying a captive labor market to the intrusion of Northern companies, with their very different and potentially disruptive wage structures. Conversely, community instability may be in the interest of some industries. For example, California growers steadfastly avoided the use of "domestic" (that is, settled) labor instead of migrants for years because of the former's greater leverage and commitment to higher wages (Calarza, 1977). In a similar way, a firm moving its plant to a "greenfield site," or one that systematically recruits workers (especially immigrants) from outside the locale, is not showing disregard for the importance of labor in location. On the contrary, management is well aware of its power to create a certain kind of community and labor force in the area. The ultimate attempt to stage-manage community formation is the company town, such as Pullman, Illinois (Buder, 1987).

Stable solutions to the dilemmas of the employment relation are possible for a time but cannot be maintained forever. Eventually the contradictions break through. The pressure may come from the side of the workers, for whom stability of employment also means long experience with an industry's control systems, growing seniority, strong community support networks, rising expectations, and so forth; these can translate into increasingly militant demands on employers. On the other hand, it may come from the company, which needs to alter product lines or raise productivity to stay competitive. A stable employment relation can be a real barrier to technical change. Or it may come from the macroeconomy, when a depression forces even prosperous industries to retrench by cutting wages or reorganizing work patterns for greater productivity. Disequilibrating forces of this kind have been hard at work in recent years. The result has been profound upheavals in the geography of industry as companies use locational shifts to re-shape employment relations and reorganize their capital (Massey, 1978a; Massey and Meegan, 1978).

A good example of such dislocation is the auto industry today. For years the industry could absorb the costs of relative labor peace and worker cooperation bought by favorable union contracts while remaining concentrated in its traditional center around Detroit. Faced with the treble pressures of economic slump, rising gas costs, and foreign competition, the companies have been building more plants away from the Midwest—in the Sunbelt and overseas—in search of a more compliant, lower-paid work force. The need to innovate to stay competitive has added an extra interest in finding workers without allegiance to existing work patterns and rules.¹⁵ Even foreign entrants to U.S. production have sought out nontraditional locations, as in the case of Datsun's new plant in Tennessee.

In sum, location and relocation are essential means of shaping and changing the employment relation in a continuing effort by management to remain competitive and contain class struggle in the workplace. Mobility in space is not a luxury for capital, but a necessity. Over time the intersection of labor and capital in space, as a critical dimension of employment, feeds back into the fortunes of capital, the evolution of technology, and, of course, the history of working-class communities. Industrial geography is thus both effect and cause of capitalist development or, rather, part of the weave in the fabric of history—not a topic apart of interest only to geographers.

CONCLUSION: THE SPATIAL DIVISION OF LABOR

The matching of labor demands from divergent industries and labor supplies from divergent communities results in what may be called a spatial division of labor. The patterns of the industrial landscape are not as large as the conventional idea of a "region," such as the "South" or the "Sunbelt." It fractures along much finer lines of disaggregated
industries and particular spatial labor markets, defined roughly by commuting fields, which are rarely larger than a few counties and can be as small as neighborhoods of cities. The fine pattern of industrial location creates what may be called a "mosaic of unevenness" (Walker, 1978). That mosaic is in continual flux, moreover, thanks to the inherent instability of the employment relation.18

The spatial division of labor has profound implication for the prospects facing class movements and human welfare in modern capitalist societies. Industrial location projects labor market segmentation and the persistent fragmentation of the working class into space. The spatial division of labor is a spatial division within labor that is forever created and recreated by the flux of capitalist development. In addition, with the inevitable divergence among industries and their labor demand, the locational mosaic means a persistent unevenness in local fortunes, even within the advanced "industrial" countries. Given this variegated reality, one should not be surprised that working people perceive genuine differences between themselves and other workers in other places as readily as they grasp common bonds within their class. With the increasing locational capability of corporations, moreover, management is becoming even more adept at playing off workers in one place against those in another (Bluestone and Harrison, 1980).

One should not, however, altogether despair for the prospects of class mobilization and social change, as have so many prophets of working-class immobilization by embourgeoisement, external and internal colonialism, one-dimensional capitalist ideology, and other structural-functionalist theories of an unyielding capitalism. The problem for political theory, as for the industrial workers who toil in their multitude of workplaces and communities, is to build on the particular—the experiences and social bonds and visions of a great variety of people. Intellectual radicals have often been too quick to make sweeping analyses, judgments, and plans of and for everybody else. While it is essential for political change that we try to grasp the general outlines, or underlying logic, of capitalism and promote a thoroughly different socialist order, it is not enough. People must also find in themselves the need for change. History has never yet moved by the grinding of structural gears or the pulling of the self-appointed vanguard. The creation of a more truly humane world, in which the mass of people are more in command of production and social life, will certainly not appear without the participation of those people. The problem for left research, then, is to discover the links between the general and the particular, or structure and agency, in capitalist life, so as to help others see the sources of their plight and discover a way out. And an essential place to begin that search is in the intersection between industry, labor, and geography.

NOTES

1. Research for this paper was carried out under a grant from the National Science Foundation. Much of the background evidence and literature can be found in Storper, 1982. See also Storper and Walker, 1983.

2. Three points of clarification: labor is not the most important factor in every industry or plant location decision; the movements of capital must also be pushed to the forefront of locational analysis, as we have argued elsewhere; with some modification, the basic thesis established here for manufacturing could be extended to office location. See Walker and Storper, 1981.

3. Given the clash between marxist and nonmarxist terminology, we adopt these conventions: labor, workers, laborforce and workforce refer to people; work, production, work process and labor process refer to the activity of those people.

4. The first two correspond to characteristics of labor already mentioned. The first combines performance capacity and actual performance (control). The second combines conditions of purchase and reproduction. The third introduces the reproduction of the unit of capital, i.e. investment, profitability, and accumulation.

5. In so doing we ignore questions of aggregate dynamics of the economy and the internal organization of the modern corporation, both critical but beyond the range of this paper. See Walker and Storper, 1981.

6. For a defense of this "structural-realist" approach see Bhaskar, 1975, and Sayer, 1979.

7. Although they would be compounded over time by agglomeration economies, one of the chief advantages of spatial concentration, however, is sharing a labor pool. Silicon Valley electronics are a clear example of this phenomenon (Saxenien, 1981).

8. Machines are still remarkably stupid by human standards, despite the exaggerated claims of the media about robotics. There are, of course, plenty of cases where people are so cheap they are used in jobs requiring only brute strength or simple repetitious motions. This does not overturn the centrality of labor; it merely shows the inverted values of some societies (Marx, 1967). People are still, in general, one jump ahead of the machines. There have as yet been no reports of a machine building a person.

9. We disagree with the "Braverman school" and its rather one-sided portrayal of capitalist power and the implications of "deskilling" for labor. Undoubtedly capitalists systematically attack the power of certain workers over the organization and pace of production, as well as reducing their scarcity value, through work rationalization, mechanization, and automation (Braverman, 1974; Stone, 1974; Montgomery, 1979). But this tendency is countered in three ways: (1) New jobs are created (chiefly in office work) that have the characteristics of the former "master workman" in manufacturing. Even the low-paid secretary develops
a fund of personal knowledge about his/her job that cannot easily be replaced by a machine or even another person; (2) Increased automation may reduce the worker to a “machine tender,” but one with considerable responsibility for the smooth operation of the machinery and a need for a wide range of learned tasks (“polyvalent skills”); (3) Even unskilled workers must often undertake non-routine tasks, deal with unforeseen problems (materials design, equipment failures, etc.) and interact socially in collective work situations. Auto workers and machinists constantly cope with awkward tasks because parts or materials are not right; (4) The term “skill” inadequately captures the many dimensions of individual jobs and workers, such as autonomy, adaptability, endurance, strength, agility, received wisdom, invention and patience.

10. There are few cases of pure control-induced technologies, however. One example is the short-handled hoe (Murray, 1982).

11. We used a scale of 1–8 for each dimension of technology; most of the 64 cells did not correspond to real technologies and the remaining cells could be grouped into nine clusters. Four of the six most common types were chosen for case studies. For each sample industry we used detailed job data gathered by the Bureau of Labor Statistics to corroborate the hypothesis that they could be characterized in terms of a dominant technology or technologies. Three of the four had single peak distributions of job technologies. The semiconductor industry, on the other hand, had a distinctly bimodal distribution. This is not a rare occurrence. Hence the number of production process types in the economy must be greater than the nine basis technologies (Storper, 1982).

12. Location as “matching” labor demand to labor supply is only a first approximation to the dynamic process of employment in space, however. See text below.

13. So does technology. Management does not have a simple choice of pre-designed technologies. Operating production systems undergo modification as they are put into use, thanks to the imperfect design and construction of machinery and the inevitable worker input of technical know-how into machine operation and their own work.

14. Some good studies of the integrated development of an industry and a town or region are Saxenian, 1981; Dawley, 1976; Walkowitz, 1978; and Cumber, 1979.

15. As a result, one repeatedly finds an inversion of expected center and periphery relations in which more technologically advanced plants are found in previously unindustrialized areas. This is not a new phenomenon, but it does seem to be more widespread today than ever before.

16. This flux should be seen in connection with “waves of investment” in regional and urban development, as discussed by Massey, 1978b and Walker, 1981. See also the comments on spatial disequilibrium in Harvey, 1981.

REFERENCES


The Spatial Division of Labor


