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In theory, post-Fordist work processes achieve flexibility by using new information technologies and less- hierarchical forms of management to respond to rapid changes in product markets. The discussion of post-Fordist regimes is part of a long-standing debate about the relationship between technology and the skill content of production jobs. Drawing on case study material, this paper examines the experiences of shop floor workers when new technology and new management practices were introduced. Rather than greater flexibility as predicted by post-Fordism, it finds a trend toward greater standardization and displacement of discretion from craft-based to engineering-based knowledge.

POST-FORDISM

Many analysts claim that the post-Fordist restructuring of work was ushered in by a crisis in mass production industries. Disagreement lies in what is driving the crisis (changing product demand or changing technology), and whether the situation marks a return to craft-based labor process or a movement toward a new integration of mental and manual labor. Increased volatility in consumption patterns makes small batch production more desirable, while microprocessor technologies make it economically feasible. Adaptable production systems, however, require more discretion and intellectual activity from production workers than what was demanded by the simplified tasks characteristic of mass production.

The post-war period has been marked by debate about whether new technology tends to upgrade or deskill production work. In the 1960s Robert Blauner proposed that automation would free workers from standardized work. A decade later Harry Braverman argued that knowledge of production processes shifted from workers to management, while the work itself became rote and deskilled. During the 1980s several theorists argued that the impact of new technologies would vary according to the social conditions in the workplace. Paul Adler linked the recent interest in a flexible, post-Fordist regime to this labor process debate.

While proponents of post-Fordism make bold claims about its ability to transform the nature of work, critics point to conflicts of interest and of perspective within organizations - conflicts that tend to heighten inertia and may lead to complex, even contradictory results.

CASE STUDIES

This focus on broad-based economic factors, like product markets or technical innovation, can remove the framework of analysis away from the workplace realities the theory purports to describe. To get a deeper understanding of the relations of production as they exist and are experienced at the shop floor level, the authors conducted an extensive qualitative research project based in part on interviews, informal conversations, and observations at four paper mills that vary in size, age, product mix and locale, but that are all operated by the same multi-national firm. The company recently restructured its production technology and management systems at these four plants and seems receptive to the tenets of post-Fordism.

The mills use continuous process technology to produce pulp from logs, wood chips, and chemicals, spread the pulp on wire frames to dry and finish, gather it on huge rolls, and then cut it into sheets or feed it onto smaller rolls. Before automation, workers were in close contact with their own part of the process and product. They listened to machines, felt the texture of the pulp or the dryness of the sheets, watched colors set or smelled the chemical mix. Knowledge built up over a succession of jobs was closely guarded and used to make decisions about the work flow.

The company's recent innovations involved three principal elements. First, distributed control systems were installed that use computer terminals to represent and control production. . Second, total quality management was adopted, including Statistical Process Control (SPC) and team-based management. SPC set up production targets and quantified them as centerline values with confidence intervals within which variance was allowed. And third, systems were installed to facilitate communication and information management. Workers now have more information, but little or no direct contact with the process. SPC established decision-making parameters, but reduced workers' discretion. So far teams have only had limited responsibilities. Workers were, and still are, isolated from each other and from an understanding of the overall system of production. Although processes at the wet and dry ends are highly interdependent and sensitive to variations in quality and pace, the development of worker skills and job ladders are organized on a department basis so that communication between processes is difficult and sometimes faulty.

EFFECTS OF CHANGE

The changes just described appear conducive to post-Fordist transformations by making information and decision tools widely accessible, while laying the groundwork to allow teams to break down hierarchies and departmental isolation. However, the reality observed at these plants differed from these expectations, especially in three respects. First, process engineers became more important. Not only was the number of engineering positions increased to monitor production, engineers came to fill more and more supervisory jobs, blocking production workers from moving into them. Second, legitimate knowledge came to reside in scientific and engineering discourse, rather than worker experience. Engineers derided workers' knowledge as amateurish or superstitious, while workers found it hard to make the transition from direct sensory knowledge of the production process to information equipment and theory-based knowledge. Third, decisions became standardized, particularly through SPC, which set up rule-based procedures around accepted parameters. Ironically, the rules themselves were often based on customary values derived from shop floor experience.

DISCUSSION AND CONCLUSIONS

The four paper mills under study deviate from the expectations of post-Fordist theory in several ways. While workers' skills have risen as they learned to operate computer-based equipment, their autonomy has not increased and the synthesis of mental and manual labor has not occurred. The hierarchy in the firm has been resistant to change. An explanation for this is not likely to be found in reliance on mass production formulae, as some analysts might suggest, since each plant produces a wide mix of products, and niche production areas were no more likely to adopt flexible work systems than mass production departments.

Two other explanations seem more plausible. First, the larger society offers few resources in support of craft-based production; and second, engineers are situated to gained more than production workers from restructuring initiatives. Workers remain embedded in intra-departmental job ladders. They have job security and protected skills with specialized knowledge (and occasionally use this knowledge to resist the arrogance of engineers), but remain isolated and less able to compete for larger, more autonomous roles within the mills. Engineers, on the other hand, have a cohesive occupational group, a shared sense of mission, and an expertise validated by the larger culture. They are encouraged in a career path that moves through several areas of the plant and builds knowledge of the production process as a whole.

This research suggests that analysts need to pay more attention to the micro-political effects of restructuring, particularly in light of the kinds of contradictory impulses observed in these paper mills. Management wants more commitment to quality from production workers, yet has undermined worker discretion. Product markets and technology are important influences on workplace organization, but "under circumstances in which craft knowledge has been defined as a sign of backwardness, and definitions of officially sanctioned knowledge shift to the advantage of engineering discourse, flexible work structures seem unlikely to take root *regardless* of the market or technological conditions that obtain." [356] International comparisons indicate that countries with strong craft traditions are more likely to adopt flexible work systems, while others, like the United States, may end up with a hybrid, contradictory strategy that combines high-tech production with Taylorist organization.

Three suggestions emerge from the research. First, in the context of Statistical Process Control, establishment of norms and acceptable variances could be undertaken by production teams based on workers' knowledge and experience. Second, there is evidence that process engineers who grew up near the plants where they work share ties and allegiances to production co-workers and are more willing to respect craft-based knowledge. Third, opportunity structures should be expanded. Supervisory positions should not be restricted to engineers; and training and job bidding procedures should encourage manual workers to work in other departments and gain more comprehensive knowledge of the plant as a whole.