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Worker Participation in Diverse Settings:
Does the Form Affect the Outcome, and
if so, who Benefits?

Rosemary Batt*

Eileen Applebaum†

*Cornell University, rb41@cornell.edu

†Economic Policy Institute

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WORKING PAPER SERIES

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Rosemary Batt
Center for Advanced Human Resource Studies
Cornell University

Eileen Applebaum
Economic Policy Institute

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**Worker Participation in Diverse Settings:
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Introduction

This paper utilizes extensive surveys of workers in three occupational groups (network craft workers, semi-skilled office workers, and semi-skilled machine operators) in two very different industries (telecommunications and apparel)ⁱ to examine the outcomes of workplace innovations. Our central question has two parts. First, what are the outcomes of off-line employee participation programs versus on-line work reorganization experiments? Second, who benefits from which type of innovation: employees, employers, or both? To answer these questions, we consider the effects of off-line versus on-line innovations on workers' satisfaction with their jobs, on their commitment to the companies they work for, and on their perceptions of their performance. We draw on surveys conducted in 1994 at multiple locations within a large regional Bell operating company providing local telephone service and in six plants of three multinational apparel companies (two plants per firm) in the basics segment of the industry. The industries and occupational groups differ along important dimensions, including the production of a service or a good, the degree of competitiveness in the industry, the type of technology utilized, the workers' relationship to technology (whether they "work on" or "work with" technology, see Zuboff 1988), and the required levels of education.

Despite these differences in industry, occupation, and work setting, the companies in this study have taken similar concepts of employee participation, work reorganization, and job design and adapted them to fit their different requirements. We have a unique opportunity, therefore, to revisit some of the major debates in the literature on employee participation and to examine how robust our own findings are across widely divergent groups of workers.

While many of the current work restructuring efforts in U.S. organizations utilize employee participation, the forms which participation takes vary. This paper focuses on the question of whether the distinct forms of participation differently influence worker attitudes and worker perceptions of performance. Levine and Tyson (1990) distinguish between consultative and substantive forms of participation. In consultative forms, employees provide information or advice, but management retains the right to make decisions. In more substantive participatory systems, workers have greater autonomous control over methods and pace of work and make decisions that substantively affect the production process. These forms of participation are not mutually exclusive, but may exist in combination in a given workplace. This distinction between

consultative and substantive forms of participation is sometimes referred to as "off-line" versus "on-line" participation (e.g., Rubenstein, Bennett, and Kochan 1992). This usage distinguishes between workers who make suggestions to management through problem-solving groups off the job and workers who make decisions with respect to work tasks or quality control as a part of their daily job responsibilities.

Appelbaum and Batt (1994) distinguish between team-based and lean production systems, and argue that while both systems may improve firm performance, team-based systems are more likely to benefit workers because of the greater likelihood of job enhancement, autonomy, and skill-development associated with team-based systems. Team-based systems rely more heavily on decentralized decision-making by workers in jobs that are designed to be broad and collaborative. Workers may also participate in off-line problem solving teams or interdepartmental task forces on an as-needed basis. Lean production involves workers in off-line problem-solving groups or process improvement teams, but generally does not fundamentally change the organization of work and the design of jobs. In some instances, however, off-line groups may have the capacity to make recommendations that affect the redesign of jobs and work organization.

The question addressed in this research is whether, in the three industry and occupational groups in this study, the results of participation in off-line teams differ from those of participation in on-line work teams, and if so, who benefits from which innovation. We first consider the case study evidence from qualitative interviews with managers and workers as to the advantages and disadvantages they experience in adopting off-line and on-line innovations. We then use multivariate analysis of survey data from workers to test empirically whether changes associated with off-line versus on-line participation positively affect job satisfaction, organizational commitment, and workers' perceptions of the quality of the work done by their work group.

Our multivariate analysis controls for other human resource and employment relations practices that current research indicates should affect the implementation of participation programs. Our earlier work (Appelbaum and Batt 1994) supports the view that high performance work systems require a coherent system of work organization, job design, human resource, and industrial relations practices, as suggested by Kochan, Katz and McKersie (1986) and others. Recent evidence suggests that embedding employee participation in a coherent system of supportive human resource, employment relations, and other workplace practices leads to larger improvements in outcomes of interest than can be obtained through participation alone. This has led some researchers to adopt a strategy of clustering workplace innovations and

using these clusters as explanatory variables in analyzing the effects of innovative practices (Cutcher-Gershenfeld 1991; MacDuffie 1991: Chapter 4; Ichniowski, Shaw, and Prensushi 1993). Cluster analysis, however, does not allow us to disentangle the relative importance of different types of innovations. We have chosen, therefore, a multivariate approach to examine the effects of on-line and off-line participation on outcomes of interest and to control for the effects of other human resource and employment relations practices.

Our choice of dependent variables reflects our interest in sorting out who benefits from innovations. Improvements in job satisfaction clearly benefit workers, but may also benefit firms if the satisfaction motivates workers to improve performance. Employees' organizational commitment benefits companies by limiting turnover costs and may improve competitiveness if the sense of loyalty to the organization induces employees to increase discretionary effort. Better work group quality enhances firm performance, but may also benefit workers by increasing their sense of accomplishment and pride in workmanship. We analyze similarities and differences across the three groups, and use our extensive field research to help interpret any differences we observe.

Our main findings may be summarized as follows. First, for the industries and occupations in our study, on-line participation -- either through the job design characteristics associated with team-based production systems or through team effects or synergies that transcend particular job characteristics -- has consistently stronger effects on job satisfaction, organizational commitment, and perceptions of work group quality than does off-line participation, which is almost always insignificant in these analyses. We also considered the effects of on-line and off-line participation on workers' satisfaction with participation or their perceptions of their influence over decision-making. We again found that job characteristics associated with on-line teams had significant positive effects on worker attitudes; off-line participation was not significant for craft workers, was mildly significant for service, and was strongly positive for apparel workers.

Second, workers benefit from team-based systems through enhanced jobs that are more likely to produce a sense of accomplishment and make better use of workers' skills. They are more likely to have influence over decisions affecting the way work is done and are more likely to enjoy greater work-group cooperation and/or informal training and information sharing. Together these produce greater overall job satisfaction, although in two cases, the increased workload (network craft) or stress (sewing machine operators) associated with teams has a negative effect on job satisfaction. Third, firms benefit from team-based production through greater work group quality, as reported by workers. In one of the three cases (network craft),

teams also have a positive effect on organizational commitment, and this commitment in turn is a significant determinant of perceived work group performance. In a second case (sewing machine operators), teams have a negative effect on commitment, but commitment is insignificant as a determinant of work group quality.

The paper is organized as follows. The next section reviews the relevant literature; the third section analyzes the role of on-line and off-line participation in each industry and occupational setting; the fourth section describes the data and presents the findings from ordered logit and OLS regression analyses, and the fifth section presents our conclusions.

Theoretical Perspectives

The pace of change in human resource practices and work organization of U.S. firms has accelerated since the early 1980s. A review of surveys of organizational change carried out between 1982 and 1992 suggests that workplace innovations have become more prevalent in American workplaces and have penetrated more deeply into the companies in which they have been undertaken (Appelbaum and Batt 1994: Chapter 5). These workplace practices include off-line participation in problem-solving and quality improvement teams, on-line self-managed work teams and mini-enterprise units, compensation and training practices that encourage teamwork and skill acquisition, and industrial relations practices that improve labor-management relations.

The effects of these innovations on worker attitudes and performance outcomes have received much attention from researchers. Most recent research in strategic human resources and industrial relations focuses on the effects of participation on firm performance, rather than on outcomes for workers (Eaton and Voos 1992; Keefe and Katz 1990; Levine and Tyson 1990; MacDuffie and Krafcik 1992; Katz and Keefe 1992; Cooke 1990; Kochan, Cutcher-Gershenfeld, and MacDuffie 1989; Katz, Kochan, and Gobeille 1983). Studies of the effects of participation find that these programs have positive or, in some cases, ambiguous effects on productivity (Kelly and Harrison 1992; Levine and Tyson 1990; Lawler, et al. 1992). Furthermore, employee participation and human resource or industrial relations practices may interact so that the sum of the effects on plant performance are stronger than the effects of the individual practices themselves (Cooke 1994). Productivity effects are expected to be greatest when plants adopt a coherent system of work organization and human resource and industrial relations practices (Dunlop 1958; Hackman and Oldham 1980; Katz, Kochan and Weber 1985; Kochan, Katz and McKersie 1986; Ichniowski 1990; Cutcher-Gershenfeld 1991; Kochan and Useem 1992; Ichniowski, Shaw and Prensushi 1993).

While most of the human resource or industrial relations literature on the performance effects of work reorganization focuses on structural changes in work practices, some studies, primarily in the organizational behavior literature, focus on employee attitudinal outcomes and whether these in turn shape performance gains or losses. This research examines whether employee involvement improves performance by changing worker attitudes and effort via increases in job satisfaction and worker commitment, or whether improvements in performance are the result of structural changes in the organization of work itself. Locke and Schweiger (1979) found that job satisfaction improved under employee participation but performance did not. Cotton et al. (1988) found that performance outcomes vary across the form of employee participation, e.g. quality circles, quality of worklife programs, autonomous teams. In a recent survey, Cotton (1993) found that autonomous work teams have a stronger effect on productivity and worker attitudes than do quality circles. Alternatively, Parker and Slaughter (1988) argue that lean production emphasizing just-in-time inventory systems increases worker stress and cite NUMMI as an example.

The link between worker attitudes, organizational structures, and firm performance is discussed extensively in the literature on work teams. In contrast to off-line participation, work teams necessitate a fundamental redesign of the jobs of team members. Job characteristics theory relates job characteristics to the fulfillment of psychological needs (Hackman and Lawler 1971), and identifies five core dimensions or characteristics of jobs -- task variety, autonomy, feedback, identity, and task significance -- that are expected to influence team effectiveness through their impact on motivation and job satisfaction (Hackman and Oldham 1975 and 1980: Chapters 7 and 8)ⁱⁱ. Hackman (1982) also points out that team effectiveness is reduced if the team experience frustrates the needs of team members. By contrast, sociotechnical theory views team self-regulation as the primary mechanism through which the design of work influences outcomes. This theory is quite similar to job characteristics theory in its identification of the key attributes of work design that contribute to team effectiveness (Pearce and Ravlin 1987). However, while motivational effects are acknowledged in sociotechnical theory, the main argument is that it is the work group's capacity to make on-line decisions and process improvements that improves work team performance (see Cohen 1993 for an excellent discussion of these issues). Workers benefit through greater autonomy.

The evidence for these competing views is mixed. Some studies find that self-managed work teams (or autonomous work groups) and/or job design characteristics have a favorable effect on work attitudes and organizational commitment (Cordery et al 1991) or on job satisfaction (Kemp et al 1983). Others find that participation affects productivity positively but is

only weakly linked to satisfaction (Miller and Monge 1986) or that self-managing teams have a positive and generally larger effect on productivity than other types of interventions but are negatively associated with job satisfaction (Macy et al, cited in Goodman, Devadas, and Hughson 1988:311). By contrast, Wall et al (1986) found that autonomous work groups did not affect job motivation or organizational commitment and did not affect work group performance; but Cappelli and Rogovsky (1994) found significant direct effects of employee involvement in work organization on organizational commitment and individual performance, as well as indirect effects on these variables via job design characteristics.

Participation and Work Reorganization in Telecommunications

The regional Bell operating company that forms the basis of this study is representative of other Bell companies in its strong financial position and protected markets. It is a large quasi-public bureaucracy with a regulated monopoly in local telephone service. Its monopoly position has been challenged in recent years by alternative access carriers such as Teleport that build fiber optic loops in business districts and cream-skim the most lucrative customers; moreover, pending national legislation would deregulate local services just as long distance was deregulated in 1984, allowing cable TV and long distance providers to enter the local market. In anticipation of this increased competition, the Bell companies have pursued two types of organizational reform that have competing logics: downsizing and reengineering on the one hand, employee participation and job redesign on the other. They have downsized telephone subsidiaries by 28 percent over the last ten years -almost entirely through attrition and generous voluntary retirement programs -- but have recently announced layoffs for the first time since the Depression; 88 percent of workers surveyed said their employment security had fallen in the last 2 years. This break with their historic social contract of long-term job commitment has made employment security a central issue. Downsizing has also increased workloads and stress for roughly three-quarters of the workforce, as reported in employee surveys. At the same time, the companies are calling on employees to increase their effort and commitment in providing quality service through participation programs intended to enhance worker input and discretion.

The regional Bell company in the study implemented a Total Quality program designed to increase employee involvement in process and service improvements through "quality action teams." The program gained the active support of workers and the union because it built on a longstanding and popular QWL program. Over 85 percent of employees received training in total quality; 12 percent have participated in a quality action team and 22 percent in QWL committees. In addition, the company and union agreed to institute a voluntary self-managed team program that allows work groups to absorb supervisory tasks but does not affect

compensation or benefits. Currently, roughly five percent of the workforce in network and customer services are participating.

Workers and the union support the concept because it frees workers from the historic problem of over-supervision in the industry. Among workers surveyed for this study, over 75 percent who are currently in traditional work groups say they would volunteer for teams if given the opportunity. By contrast, less than 10 percent who are now in teams say they would like to return to traditional supervision. Firms expect self-management to allow workers to be more creative and responsive to customer needs; the teams also allow companies to cut indirect labor costs and double or triple the spans of control of first-line supervisors, from a range of 1:6-10 to 1:15-30.

The network crews who are involved in these programs hold highly skilled and autonomous craft jobs that were historically resistant to Taylorism: building and maintaining the network transmission and switching infrastructure required workers to have electro-mechanical skills and knowledge and to complete a whole task -- for example, an installation or a service repair. Geographic dispersion reinforced autonomy. This group continues to hold highly skilled, blue collar, craft jobs; and workers are 90 percent male. Historically, Bell companies hired high school graduates for these jobs, but new recruits are expected to have an associate or technical degree in electromechanical skills.

The idea behind self-managed teams in network is that they allow installation and repair (I&R) crews to take responsibility for serving customers in a given "turf" or geographic area, similar to a small business unit concept. Firms anticipate improved quality and productivity because workers know that only they are responsible for their turf -- a great incentive for preventative maintenance over quick fixes, an historic problem in the industry due to the routine use of purely quantitative performance measures. Productivity is also likely to increase because workers don't have to delay service to check with supervisors about nonroutine problems; instead, they can solve them on the spot or call a fellow team member for helpⁱⁱⁱ. One manager called self-managed teams, "... the patrol officer model in which each telephone repair team has a 'beat'. It allows local residents to get to know their repairmenallows them to ask for help if they see repairmen in neighborhood ...allows teams to handle more than one problem at a time. Under the old system, a customer with a problem called into a dispatcher who notified the foreman who assigned the work to an individual randomly. Now the customer calls the team directly and the team gets right on it. Faster cycle time, better service" (Batt 1995).

Even in rural areas with traditionally more autonomous work groups, the shift to formal self-managed teams changes the responsibilities of workers who absorb both the internal

administrative duties of supervisors and the external duties of interacting with customers as well as other departments to get the job done. This includes ordering supplies, bringing in jobs, negotiating with parties over turf responsibilities, answering customer complaints, and working with engineers in the pre-survey stage, craft workers now assume these responsibilities. In the language of quality consultants, craft workers interaction with both internal and external customers has grown.

Workers in self-managed network crews say they like it better because of the greater autonomy ("no supervisor spying on you"), greater cooperation and informal training between more and less experienced craft workers, greater authority to work directly with engineers and other "subject matter experts," and greater recognition ("now if a job goes well, we get the credit"). Sixty-two percent of team members say they routinely help one-another with problem-solving, versus only 35 percent of traditionally-organized groups; and twice as many (40 percent versus 22 percent respectively) say that relations between co-workers have improved in the last two years (period in which teams have been introduced). Teams are significantly more likely to use group, as oppose to individual performance measures (59 percent versus 31 percent of respondents). And twice as many workers in self-managed versus traditional groups say they routinely interact with managers outside their department (35 percent versus 17 percent). Team members tend to dislike, however, the added paper work as well as the responsibility of having to do quality inspections. The majority of team members surveyed also said that self-managed teams create friction between self-managed and other work groups (58 percent) as well as among members within the work group (68 percent). Workloads also appear to be slightly higher: 48 percent of team members say they are frequently understaffed, compared to 41 percent of traditionally supervised workers.

In contrast to network crafts, self-managed teams are more difficult to establish in customer services because current technology and office rules more fully constrain employee discretion. Customer service workers take orders (sales representatives) or answer questions (billing and collections representatives), manipulating computer databases to pull up or input customer information. The jobs require at least a high school diploma, but most workers have some college or-post-secondary education. The jobs have become increasingly complex and stressful because companies have dramatically expanded the varieties of service they offer and because there is greater pressure to sell. Increased workload and stress, therefore, is generalized, and is not associated with self-managed teams per se. Additionally, new technologies such as automatic call distribution systems have increased constraints by automatically pacing incoming calls. Call-loads are set at the state level so that not even lower

or middle level managers have discretion over scheduling breaks and assignments. To give these workers the time away from the board needed to absorb supervisory tasks, supervisors would have to reduce the workload or call-load of the teams; many supervisors are unable or unwilling to do this, either because workloads are already too heavy as a result of downsizing or because giving "special treatment" to self-managed groups will create resentment from other workers^{iv}. There is less ability for teams to create a "closed system," unless an entire office becomes self-managed; but "mandating" participation may undermine the positive effects of the voluntary program.

As a result of these organizational and technological constraints, experiments in self-management in customer services have been less able to bring about major changes in job characteristics, although team members do report significantly higher levels of autonomy. In general, however, we would expect to see fewer significant differences in survey responses of self-managed and traditionally organized workers in customer services. Yet even in this highly constrained environment, only 6 percent of team members say they would return to traditional supervision, and three quarters of traditional workers would volunteer if given the opportunity.

In customer services' experiments with self-managed teams, service representatives absorb both the administrative tasks for the work group and the job of interfacing with "subject matter experts" in other departments to find out answers to non-routine questions or problems that arise. Workers say they like this change because it requires managerial staff in other departments to give to workers the respect and credibility normally reserved for professional and managerial employees.

Additionally, teams report that a benefit of moving to self-management is the improved motivation that comes from having more independence, gaining respect, and working as a team. More learning takes place among group members who share knowledge in areas such as improving sales revenues, solving complicated billing problems, or handling difficult customers^v. Seventy percent of team members say they routinely help each other with problems, versus only 54 percent of workers who are traditionally supervised. Similarly, 59 percent of team members say that co-worker relations have improved in the last two years, versus only 32 percent of those in traditional work groups. Both workers and firms appear to benefit, therefore, but the differences between teams and traditional groups are not as strong or pervasive in customer services as they are in network.

Participation and Work Reorganization in Apparel

Employment in the apparel industry has declined steadily from its peak at 1.3 million workers in 1979. Nevertheless, 977,400 people were still employed in this industry in 1993,

733,000 of them women (Employment and Earnings 1994). The moderate skill requirements in the industry and its easily copied and cheap technology leave the industry vulnerable to competition from firms in countries with much lower hourly compensation costs. Competition from overseas producers paying wages that are a fraction of U.S. wages led imports to climb despite the imposition of tariffs and volume quotas. By 1987, about half of total U.S. expenditure on apparel was spent on imported garments.

Competitive pressures increased for domestic apparel producers during the 1980s as mergers and acquisitions among U.S. retailers -- the apparel manufacturers' customers -- both increased the size of the acquiring firms and left them with exorbitantly high debt levels. The high debt service made retailers more cost conscious, while their larger size and smaller numbers increased their monopsony power and enabled them to make new demands on manufacturers. To reduce the costs of markdowns that occur when goods in inventory don't sell, stock outs that occur when items customers want are out of stock, and the general costs of carrying inventories, retailers have stepped up their demand that domestic apparel manufacturers make just-in-time deliveries when stocks are low.

The changed requirements of retailers conflict with the traditional form of work organization used by apparel manufacturers. Reducing the amount of direct labor in garments has been the traditional means by which apparel manufacturers and contractors have tried to cut costs and improve productivity. The basic approach was to maximize the output of individual operators -- to isolate each stage of the production process, engineer and rationalize it, and fragment the production process and to pay operators by the piece. This extreme fragmentation of the production process is facilitated by the accumulation of in-process inventories. In the bundle system, substantial amounts of inventory are (literally) tied up in the bundles of cut garment parts on which each operator is working, performing one very small task (sewing a hem or attaching a pocket, for example). There are typically between 15 and 20 days of work-in-process in plants producing garments requiring no more than 20 minutes of labor, although this has been reduced somewhat in well-run bundle plants. While apparel production in the bundle system takes the work of many operators, the system is designed to minimize the total amount of direct labor and the labor cost in each garment.

While labor productivity and utilization of machines are maximized at each stage, the traditional system has many weaknesses. The accumulation of inventories adds time to the production cycle; maximizing the productivity of individual workers may not maximize the productivity of the system; and the minute engineering of each small step makes it more difficult to change styles. The system is inflexible and responds sluggishly to market changes.

The fragmentation of apparel markets and the demands made by retailers on their suppliers have called into question the viability of traditionally organized domestic apparel firms that attempt to compete with imports on the basis of automation and wage cutting. The greatest advantage that U.S. apparel producers have is their proximity to the huge domestic market. But the traditional production system is not based on the flexibility and fast turnaround times needed to exploit the advantage of proximity. The innovative apparel plants in our study adopted two different approaches to reorganizing production to solve the inventory, flexibility, and throughput problems of the bundle system: a team-based modular production system and an alternative manufacturing system that organizes operators working on bundles into larger vertical production teams or mini-lines.

In modules, groups of between two and ten operators work as a team to assemble an entire garment. After each operator completes a task or series of tasks, she passes the garment piece directly to the next operator. Team members consult with each other to solve problems and continuously rebalance the work to eliminate bottlenecks. In well-functioning modules, imbalances are corrected without any intervention by a supervisor. As a result, modules drastically reduce in-process inventory and the time it takes for a given piece to be turned into a finished garment. Workers become involved in the quality and pace of production of their co-workers. The extent of self-management varies somewhat among plants. In general, supervisor-to-worker ratios are reduced from 1:25 in bundles to 1:100 in modules as workers assume supervisory responsibilities for making simple repairs to the machines and for tasks such as scheduling paid time off and dealing with absences. In one plant, modules go through a certification process and are then completely self-managing.

Working in a module requires the operators to be able to do a variety of sewing tasks and to operate several different sewing machines, and greatly increases training requirements. While formal training is higher for operators in modules than for those in bundles, much of the training is informal as team members share short cuts. Module operators are much more likely than other sewing machine operators to have acquired skills through job rotation. Team members have a role in organizing the flow of work and in setting and meeting group goals, and in some cases even decide on the physical arrangement of the sewing machines. Self-management of the interactions among group members is important in a module, and a high degree of communication, cooperation, and coordination is required among the operators as they set production goals, solve quality problems, rebalance the work, and resolve conflicts. In contrast to workers in the bundle system, significantly higher percentages of workers in modules report that their job makes good use of their skills and knowledge and requires them to

learn new things. They also report that their job requires them to be creative and that they find their work challenging.

Higher levels of stress do appear to be associated with modules in this study. operators. in modules are significantly more likely to report that they are now required to work faster. In our field research, we observed two factors that appear to contribute to greater stress. First, modules facilitate the introduction of a larger number of styles, but in one plant, the number of styles introduced appears to be unreasonably high. Second, peer pressure which plays an important positive role in maintaining the pace of work and in reducing absenteeism also has some negative effects. In one plant workers received a group piece rate, and workers indicated that this practice created increased pressure and stress when any one individual performed below her usual rate.

Compensation practices change when modules are introduced. Individual piece rates are usually abandoned in favor of hourly wages plus quality and quantity bonuses (or as in the case above, for a group piece rate). Pay for skills to encourage skill acquisition and reward multi-skilled workers is rarely used. Workers in the modules in this study do not earn more than their counterparts in mini-lines or bundles.

There are high up-front costs associated with transforming a plant from the bundle to the module system. Management must supply each team with a full complement of machines required to produce finished garments. In the plants in this study, this raised the machine-to-operator ratio from the 1.1 figure common in traditional bundle plants organized on a one worker/one machine basis to between 2 and 2.5 machines for teams that varied from 3 workers/6 machines to 10 workers/25 machines. Training costs also rise. It typically takes an operator six weeks to become proficient in one operation. To perform 4 operations increases training in job skills from a few weeks to nearly half a year. Most teams are given several days of training in team-building and problem-solving skills as well.

Mini-lines are a recent innovation introduced by managers to overcome the well-documented disadvantages of the bundle system without the large investment in machinery and training in job skills and without the major reorganization of the production process and change to a more participatory organizational culture that the module system requires. The mini-lines in our study consist of 29 operators, on average, grouped together to produce a particular type of garment starting with the cut pieces and finishing with a fully assembled product. The size of the mini-line is determined by the number of operations required to produce a garment, since operators in mini lines still work on bundles and are primarily responsible for a single operation. Physically, the layout of the plant floor is similar to that of a traditional bundle

system, although workers are sometimes arranged in a large horseshoe. Workers in mini-lines continue to be monitored by a supervisor who coordinates the production process. Some mini-lines choose team leaders, but this is a very circumscribed position.

The major innovation in the mini-line system is that it does away with the piece-rate incentive system and replaces it with an hourly wage and group bonus system. As a result of the change in compensation, workers no longer have incentives to create large backlogs of work-in-process in order to maximize earnings. Workers who get ahead of the group are encouraged to move to other parts of the mini line to help slower workers and to eliminate bottlenecks. The new payment system frees up operators to move from one task to another. Workers receive formal training in two to four operations, but they usually spend most of their time on just one of these. Workers do not have much opportunity for face-to-face interactions or to coordinate the production process. Managers have attempted to compensate for this by providing formal training in team-building and problem-solving skills, as well as opportunities for off-line participation in quality improvement teams. Finally, there are a few extra machines available, but many fewer than the number of additional machines required in modular production.

In comparison with the progressive bundle system, mini-lines are supposed to eliminate bottlenecks and reduce inventories of work-in-process. However, in the absence of self-management the mini-line system suffers from "free rider" problems. The production system does not provide workers with incentives to take on additional tasks when they have completed their bundles or for identifying mistakes and correcting them, especially those made by someone else. In addition, despite formal cross training, there is little rotation. Finally, workers who were high earners in the bundle system find that their earnings are substantially reduced in the mini-line system, where everyone earns the same pay. These are the very workers who are capable of working most quickly and who are expected to move around the line and help eliminate bottlenecks.

Hypotheses and Evidence

Hypotheses

We hypothesize that work reorganization into on-line teams affects outcome variables both through the characteristics of redesigned jobs of team members and through the workings of teams over and above these individual job attributes. Self-managed teams in telecommunications, for example, are likely to increase the scope for individual discretion of workers, leading to more job satisfaction as well as innovative problem solving; but it should also improve performance through greater collaboration and learning among team members. In

apparel, the individual skills of workers increase as team members share shortcuts and gain skills through job rotation, but workers also become involved in the quality and pace of work of their co-workers. Both job design characteristics and the existence of self-managed teams are expected to affect workers' job satisfaction as well as organizational commitment and perceived work group quality.

We use four of Hackman's five constructs to measure job characteristics: autonomy, identity, variety, and significance^{vi}. We also include measures of workload and stress as part of job characteristics because job design theory suggests that these aspects of jobs may counter the positive effects of other attributes of the new job design (Hackman 1982). Our field research indicated that team membership often created increased workload and stress among sewing machine operators but not among telecommunications groups.

The theoretical arguments relating participation to outcomes are not as fully developed for off-line as for on-line teams. In lean production settings, however, workers may participate in problem solving and continuous improvement activities in off-line teams, but often the organization of work is virtually unchanged in comparison with traditional work sites. Adler (1993) argues that participation in off-line problem-solving teams contributes to increased responsibility and commitment on the part of workers, and that narrow jobs are acceptable to workers if workers have an important influence on the design of these jobs. This suggests that off-line teams have a positive effect on commitment and performance of work group members, although the effect on workers' job satisfaction is less certain.

We measure off-line participation by a scale created from participation in various types of off-line team meetings. Workers in apparel were asked if they meet to improve product quality, participate in a training committee with other workers and managers, participate in a health and safety committee, meet with people from other departments to solve production problems, or meet to solve other problems. Workers in telecommunications were asked about participation in quality of work life programs (QWL), total quality programs, cross-functional teams, and problem-solving teams.

We test these hypotheses in two models. Model I examines the effects on our three dependent variables of on-line participation (both through the effects of teams and through redesigned job characteristics) and of off-line participation (through quality improvement, problem solving, interdepartmental, or other teams). The only control variables in this model are demographic (age, gender, race, company tenure, and education). Model II includes other human resource management variables in addition to off-line participation (training, compensation, and employment security) as well as variables that measure employment

relations (labor-management relations, coworker relations, and union affiliation). These variables provide further controls in order to distinguish the effects of different forms of participation from other workplace practices or employment relations that may also affect the outcome variables. Figure 1 illustrates Model II. To allow for the possibility that work organization improves performance by increasing the job satisfaction and motivation of workers, we also include job satisfaction and organizational commitment as mediating variables in the analysis of the determinants of perceived performance of the work group in Model II.

Data

The data for this study include survey responses from 466 network craft and 322 customer service workers (58% response rate) from a random sample in one Bell operating company, stratified by rural/urban location and whether or not the employee was a member of a self-managed team (roughly half of each occupational group). The apparel study included three firms, each with matched pairs of plants producing the same product line, one plant traditionally organized in bundle systems, and the other plant with primarily innovative work organization. Four of the six plants are unionized^{vii}. Plant managers in five of the six apparel plants provided us with lists of all employees, by department, from which the researchers drew a random sample of workers stratified by occupation (sewing machine operator, cutter, mechanic, supervisor, and so on). At the sixth plant, a traditional bundle plant, a list of the first 100 volunteers was provided by the manager. Statistical analysis suggests that these workers do not differ systematically from other bundle workers in our study. The apparel survey covered 562 workers (69% response rate), of which 462 are sewing machine operators. This paper draws on the responses of these operators, 50.7 percent of whom work in the bundle system, 38.1 percent in modules, and 11.3 percent in mini-lines. For purposes of brevity, modules will be referred to as self-managed teams in this discussion. Mini-lines represent a hybrid form between the module and bundle systems.

To measure the constructs in our model, we developed similar survey instruments for the telecommunications and apparel industries, with some of the questions customized to operationalize concepts in the context of each of the particular occupational work settings. While many questions are identical, some vary by industry and/or occupation. See Tables 1a (telecommunications) and 1b (apparel) for definitions and scales of variables used in the analysis. Job satisfaction and work group quality are each measured by a single question; organizational commitment is an index based on questions drawn from the Lincoln and Kalleberg (1990) study of organizational commitment^{viii}.

We developed occupationally specific measures of several independent variables. Hackman's job design concepts, for example, are operationalized to fit the particular occupational groups. The union coverage variable differs by industry: in telecommunications, all workers are covered by union contract, but vary in whether they choose to be members of the union or not; the more important source of variation among apparel workers is whether or not they work in a unionized plant. For network craft workers, controls are added for variation in technology and service markets because there is significant within-company variation by geographic location.

Other measures of human resource practices and employment relations are quite similar across the industry groups. Training is a composite of different types of formal training employees have received in the two years prior to the survey, including basic (math and reading), formal technical (occupation-specific), quality, and team-building. Advancement opportunities refer to opportunities to improve skills, as formal promotions through job ladders are limited in these occupations. Compensation is measured by the level of earnings and by pay satisfaction, which captures employees' assessments of the relative fairness of their pay. In telecommunications, employment security is a scale that combines two factors -- an assessment of the employee's security and her or his satisfaction with security.

Descriptive Statistics

Tables IIa and IIb present comparisons of means of variables for self-managed teams and other forms of work organization for workers in telecommunications and apparel respectively. Several results are evident from the comparison of the means of self-managed versus traditionally organized groups in telecommunications, and in modules versus mini-lines and bundles in apparel. First, self-managed teams and traditionally organized groups differ significantly with respect to many of the critical variables of interest in this analysis. Second, as suggested in the qualitative evidence on telecommunications summarized above, implementation of work innovations in customer services is less successful than in network or apparel, although some changes are evident in job design and performance outcomes even in this constrained technological and organizational environment. And third, as suggested by the discussion of apparel above, means for mini-lines are intermediate between those of modules and bundles, and are often not significantly different from bundles.

Considering first our dependent variables, self-managed work groups in all three occupations have significantly higher levels of perceived performance, but only self-managed craft workers show significantly higher levels of job satisfaction and commitment. Self-managed service workers are no more satisfied than their traditionally organized counterparts, but have

higher levels of organizational commitment that are mildly significant. Sewing machine operators in self-managed teams are not more satisfied or committed than those in traditional work organizations. The responses of apparel workers in mini-lines are surprising: their organizational commitment is significantly higher than that of workers in either bundles or modules, but their perception of their work group's performance is not higher than that of workers in the traditional bundle system and is significantly lower than that of workers in modules. Greater organizational commitment may be due at least in part to the significantly higher levels and different types of formal training that these workers received. Seventy-six percent of mini-line workers received formal training, compared to 58 percent of module workers and only 37 percent of workers in bundles. Moreover, mini-line workers primarily received training in "soft-skills" (team-building, trust, cooperation) while workers in modules received primarily technical training. However, reorganizing workers into actual work teams appears to yield better performance results than can be accomplished by the mini lines.

Turning next to the work organization variables, the effects of job redesign are more significant and diverse for teams in network and apparel than in service work. Self-managed teams in network and apparel are significantly different from traditionally organized groups along all four-job design dimensions. In network, they score higher on autonomy, identity, and significance, but notably lower on variety. The slightly greater workloads are mildly significant. The lower score on variety is unexpected, but may be the result of workers self-selecting into the functional jobs that they prefer or perform best^{ix}. In apparel, modules score significantly higher than traditional bundles on all four-job design characteristics. They are also significantly higher than mini-lines on autonomy and variety, while mini-lines do not differ from bundles on any of these dimensions at the .05 significance level. Modules also score significantly higher than bundles on stress.

In customer services, in contrast to network and apparel, it is clear that self-managed teams have had a much smaller effect on changing the design of jobs; the self-managed groups report greater job autonomy, and the difference between the two groups is highly significant. We want to underscore the sharp contrast between successful implementation of work innovations in network and apparel, on the one hand, and customer services on the other. This finding reinforces the importance of occupation-level research. Corporate implementation of similar types of innovations can vary radically depending upon the nature and organization of work and on the nature of technology. We explore these differences in greater detail in our multivariate analysis below.

With respect to off-line participation, network craft have significantly higher levels of off-line participation while customer service workers are not significantly different. Sewing machine operators in modules also have significantly higher participation rates than those in other work settings. The means for other human resource, employment relations, and demographic variables are reported in Tables IIa and IIb. It is noteworthy that self-managed groups in general have significantly better employment relations than traditionally-supervised groups: both network and apparel teams have significantly better labor-management relations while network and customer services have better co-worker relations. The latter finding is consistent with worker descriptions of improved internal work group cooperation. There are no important differences in demographic variables among telecommunications workers. However, among apparel workers we note that workers in mini-lines are significantly more likely to be younger, male, and not white non-Hispanic, to have longer tenure with the firm, and to earn higher wages. It is not possible to determine whether these characteristics reflect a plant effect or a work organization effect, since four-fifths of mini-line members are employed in just one plant. In contrast to this concentration of mini-line workers, module and bundle workers are each located in several plants.

Multivariate Analysis

We used maximum likelihood ordered logit equations of job satisfaction and perceived group quality and OLS regression analysis of organizational commitment to estimate the two models described above^x. Tables IIIa, IIIb, and IIIc report the regression results for Model I, with job satisfaction, organizational commitment, and perceptions of work group quality as the respective dependent variables. We find that on-line and off-line participation have very different effects. Off-line participation is never significant for network craft or customer service workers, while for sewing machine operators it has a mildly significant effect only on organizational commitment. On-line participation, by contrast, is always significant, either through the effects of job design characteristics, or self-managed teams, or both. In examining the effects of innovations in work organization on the dependent variables, the omitted category is workers in traditionally organized groups. Thus, for network craft and customer service workers, the effects of working in a self-managed teams are measured relative to those of working in traditionally managed work groups. For apparel workers, the effects of working in self-managed teams (modules) or in mini-lines are measured relative to the effects of working in the traditional bundle system.

For all three groups, the job design characteristics of identity and significance have a strong positive effect on job satisfaction and organizational commitment. For network and

apparel, but not service workers, both identity and significance are significantly correlated with the introduction of self-managed teams. In addition, for both telecommunications groups, the greater autonomy associated with teams has a positive and significant effect on job satisfaction. Self-managed teams, however, have no significant effect on job satisfaction over and above the effects of individual job characteristics. For sewing machine operators being part of a module actually reduces organizational commitment while participation in mini-lines has the opposite effect.

With respect to perceptions of work group quality, the effects of working in a self-managed team are consistent and strongly positive across all three industry-occupation groups.

To sum up the results of the analysis of Model I, whether the effect is through team work or specific job design characteristics associated with teams, work reorganization has consistently stronger effects on employee attitudes and perceived performance than does off-line participation.

Insert Tables IIIa, b, and c Here

Results of the analysis of Model II, which include human resource practices and employment relations in addition to the on-line and off-line participation variables of Model I, are reported in Tables IV (satisfaction), V (commitment), and VI (group quality)^{xi}. For all three dependent variables and occupational groups, we find that off-line participation is insignificant.

We next turn to the effects of work organization on job satisfaction and organizational commitment in the larger model. For network and apparel workers, job characteristics associated with teams (autonomy and task significance for network, task identity and task significance for apparel) significantly improve job satisfaction. Similarly, for network and apparel workers, task identity and task significance have a significantly positive impact on organizational commitment. The workload and stress variable, which is introduced in Model II, has a highly negative effect on job satisfaction for these two groups of workers (increased stress is mildly significantly associated with teams in network and strongly associated with modules in apparel).

By contrast, for service workers, only task significance is a positive determinant of satisfaction and commitment (and note that task significance is not significantly correlated with self-management). Finally, over and above the effects of particular job characteristics, self-managed teams do not have a significant effect on satisfaction or commitment for network craft or customer service workers. For sewing machine operators, neither modules or mini-lines

have a significant effect on job satisfaction; but modules continue to have a negative effect on commitment and mini-lines a significant positive effect net of all other workplace practices. We also used model II to estimate the effects of on-line and off-line participation on workers' satisfaction with participation or their perceptions of their influence over decision-making^{xii}. Among both telecommunications groups, we found that on-line job characteristics of autonomy, task identity and task significance were significant determinants of satisfaction with participation (at the 1 percent level), while off-line participation is insignificant for craft workers and only mildly significant (at the 10 percent level) for service workers. For sewing machine operators, both task identity and significance as well as off-line participation were strong determinants of their perception of influence over decision-making.

Turning to work group quality, however, teams have a strong, significant, direct effect on perceived performance for all three groups, even after controlling for the effects of job design characteristics and the full array of human resource and employment relations practices. Moreover, the positive co-worker relations associated with teams in telecommunications are a significant positive determinant of work group quality. These results can be understood in the context of the work settings in each industry. The team or module organization of work has advantages at the group level that go beyond the effects of particular job characteristics on individual workers' attitudes. In the case of network self-managed teams, the advantages are often in the form of greater attention to preventative maintenance. For apparel workers, the improvements occur because of continuous elimination of bottlenecks and balancing of workloads through team self-regulation, even though workers experience more stress as a result. For service workers, teams appear to help workers through greater shared learning and problem solving in handling customer relations, not through individual job design characteristics.

In summary, these findings lend support to both the sociotechnical systems team-based explanation of performance as well as Hackman's job diagnostic model of employee attitudes, while rejecting the human resource model that focuses only on changes in managerial behavior. Under no circumstances does off-line participation affect job satisfaction, organizational commitment, or perceived work group quality, although in some cases it is a determinant of perceptions of influence over decision-making. By contrast, for all groups, self-managed team organization significantly improves perceived group quality. Moreover, job design characteristics associated with self-managed teams significantly improve workers' job satisfaction and organizational commitment. These job characteristics do not directly improve perceived performance, but in some cases there is an indirect effect: a strong significant effect of organizational commitment on network craft work quality and a mildly significant effect of job

satisfaction on service workers perceived quality. For apparel workers, neither attitudinal variable influences perceived performance.

There are also some anomalous findings that run counter to our theoretical explanations. Variety, for example, has a weak negative effect on job satisfaction for sewing machine operators. For craft workers, employment security has a significant and negative effect on work group quality, as does training -- in the latter case, perhaps the effect of increased knowledge or expectations on employees' assessment of their own performance. Also, task identity has a significant negative effect on perceived quality among service workers.

Conclusions

We have used data from worker surveys in three distinct occupations to answer the question of whether the form of participation affects the outcome, and if so, who benefits. With respect to the question of who benefits from innovations, our results show that both workers and firms stand to gain from self-managed teams, although the results are somewhat mixed for apparel workers. Firms appear to benefit from the better performance in quality associated with teams; and in the case of network craft, the higher levels of organizational commitment among team members have a positive and significant effect on self-reported performance. With respect to workers, there are significant benefits as well as some disadvantages. Network craft workers benefit the most through greater autonomy and job satisfaction, as well as through better work group and labor-management relations; but they have somewhat heavier workloads. Customer service workers benefit through increased autonomy even though overall job satisfaction is not higher. They also experience more positive co-worker relations and internal work group cooperation. Changes brought about by modules appear to have mixed benefits for sewing machine operators: on the one hand, their jobs are enhanced, and job characteristics associated with teams improve job satisfaction; on the other hand, the increased stress associated with modules reduces job satisfaction so that there is no net gain in job satisfaction for these workers.

Our analysis also supports the argument that on-line or team-based participation has significantly greater effect on employee attitudes and perceptions than does off-line participation, even in highly constrained technological and organizational settings such as customer service offices. This finding does not mean, however, that in all cases, on-line participation is more effective than off-line participation. As we indicate in our discussion of the telecommunications and apparel industries and occupations, the nature of work and technology, and the specifics of the problem which work reorganization and participation are intended to address shape the implementation and outcomes of work innovations. We currently know too

little about the nature of work and technology in different industries and occupations to be able to generalize. Because we observe similar outcomes across widely divergent occupations, however, we are encouraged to pursue this line of research; and we believe that it is only through detailed studies of industries and occupations and through surveys of workers as well as managers that we can begin to understand and identify under what conditions and why different forms of participation do in fact matter for workers as well as companies.

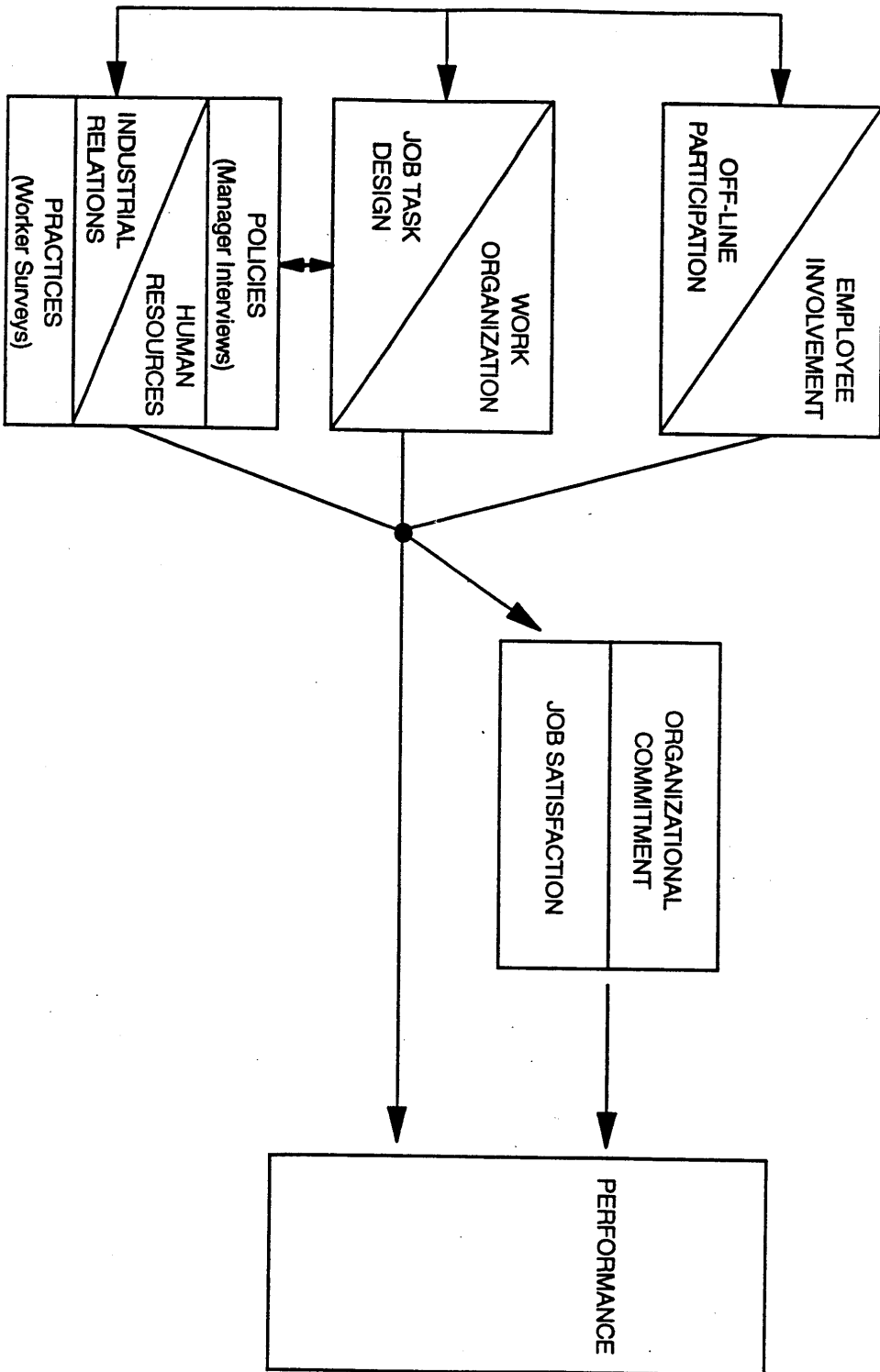


Figure 1
Theoretical Framework

Source: Appelbaum, Bailey, Berg, and Kalleberg (1994)

Table 1a
Definition of Variables

Telecommunications: Network Craft and Service Workers

Dependent Variables

Job Satisfaction

"Considering everything, how satisfied are you with your job?"
(1 = very dissatisfied to 5 = very satisfied)

Organizational Commitment: is a scale formed from the following 3 items.

"I am willing to work harder than I have to in order to help this company succeed."
"I feel very little loyalty to this company."
"I am proud to be working for this company."
(all: 1 = strongly disagree to 5 = strongly agree)

Work Group Quality

"In your opinion, what is the quality of services provided by your work group?"
(1 = very poor to 5 = excellent)

Independent Variables

Work Organization

Job Design Variables

Autonomy: is a scale formed from the following 3 items:

"Please tell us how much personal influence you have over the following things:
Deciding what tasks or work assignments you do.
Deciding what tools or procedures you use.
Controlling the pace or speed at which you work."
(1 = none to 5 = complete)

Identity

"How often is the authority you have adequate to meet customer needs?"
(1 = never to 5 = almost always)

Variety: is a cumulative scale of the following (for network craft only)

"The following is a list of different types of network craft jobs. Please check the ones you do on a regular basis.

1. Aerial cable (incl. air pressure)
2. Buried cable (incl. air pressure)
3. Aerial service wire
4. Buried service wire
5. Building entrance cable
6. Intrabuilding network cable
7. Network terminating wire
8. Digital central office
9. Digital subscriber pair gain

Table 1a (cont.)

10. Public CPE
11. Basic or nonbasic inside wire

Significance

"My job makes good use of my knowledge and skills."
(1 = strongly disagree to 5 = strongly agree)

Workload/Stress

"How often do you find you have too few employees to handle the workload of meeting customer needs."
(1 = never to 5 = almost always)

Human Resource Management**Off-line Participation: is a scale formed from the following:**

"Which of the following have you or are you currently participating in:

1. Quality action team
 2. Cross-functional team
 3. QWL team or committee
 4. Other problem-solving
- (for each, 0 = no, 1 = yes)

Training

"Please consider the following types of training and indicate how much off-the-job training provided by this company you have received in the last 2 years."

1. Technical training
 2. Basic skills training (math, reading, etc.)
 3. Quality training
 4. Self-directed team training
- (for each category)

- 0 = no training
1 = 1-2 days (recoded to 1.5)
2 = 3-5 days (recoded to 4)
3 = 6-10 days (recoded to 8)
4 = 11-20 days (recoded to 15)
5 = 20 days or more (recoded to 22)

Advancement Opportunity

"I am given a real opportunity to improve my skills in this company"
(1 = very dissatisfied to 5 = very satisfied)

Table 1a (cont.)

Compensation**Earnings**

"What are your annual earnings (including overtime)?"

- 1 = under 20,000 (recoded to 15,000)
- 2 = 20,000 - 29,999 (recoded to 25,000)
- 3 = 30,000 - 39,999 (recoded to 35,000)
- 4 = 40,000 - 49,999 (recoded to 45,000)
- 5 = 50,000 - 59,999 (recoded to 55,000)
- 6 = 60,000 - 79,999 (recoded to 70,000)
- 7 = 80,000 - 99,999 (recoded to 90,000)
- 8 = over 100,000 (recoded to 110,000)

Pay Satisfaction

"How satisfied are you with the fairness of your pay?"

(1 = very dissatisfied to 5 = very satisfied)

Employment Security: is a scale formed from the following:

"To what extent do you agree or disagree with this statement: 'I feel less secure in my job now than I did several years ago.'"

(1 = very satisfied to 5 = very dissatisfied)

"Considering everything, how satisfied are you with your employment security?"

(1 = very dissatisfied to 5 = very satisfied)

Employment Relations**Labor-Management**

"In general, how would you describe relations in your workplace between management and craft employees?"

(1 = very poor to 5 = very good)

Co-Worker Relations

"In general, how would you describe relations between co-workers in your work group?"

(1 = very poor to 5 = very good)

Union Affiliation

"Are you a member of the union?"

(0 = no; 1 = yes)

Demographics**Age**

"What is your age?"

1 = Under 25 (recoded to 21.5)

Table 1a (cont.)

- 2 = 26-30 years old (recoded to 28)
- 3 = 31-35 years (recoded to 33)
- 4 = 36-40 years (recoded to 38)
- 5 = 41-45 years (recoded to 43)
- 6 = 46-50 years (recoded to 48)
- 7 = 51-55 years (recoded to 53)
- 8 = 56 years or older (recoded to 58)

Female

"What is your gender?"
(0 = male, 1 = female)

Race

"What is your race/ethnicity?"
(recoded to 0 = white, non-Hispanic; 1 = other race or ethnic group)

Tenure

"What is your length of company service (tenure)?"
1 = Less than 1 year (recoded to .5 years)
2 = 1-5 years (recoded to 3 years)
3 = 6-10 years (recoded to 8 years)
4 = 11-15 years (recoded to 13 years)
5 = 16-20 years (recoded to 18 years)
6 = 21-25 years (recoded to 23 years)
7 = over 25 years (recoded to 28 years)

Education

"What was the highest level of schooling you completed?"
1 = some high school (recoded to 10 years)
2 = high school diploma or equivalent (recoded to 12 years)
3 = post-high school vocational or technical training institute (recoded to 13 years)
4 = some college (recoded to 13 years)
5 = 2 year college degree (recoded to 14 years)
6 = 4-year college degree (recoded to 16 years)
7 = some post-college or graduate training (recoded to 17 years)
8 = masters degree or higher (recoded to 18 years)

Table 1b
Definition of Variables
Apparel: Sewing Machine Operators

Dependent Variables

Job Satisfaction

"All in all, how satisfied would you say you are with you job?"
(1 = very dissatisfied to 4 = very satisfied)

Organizational Commitment: is a scale formed from the following 6 items.

"I am willing to work harder than I have to in order to help this company succeed."
"I feel very little loyalty to this company."
"I would take almost any job to keep working for this company."
"I find that my values and this company's values are very simple."
"I am proud to be working for this company."
"I would turn down another job for more pay in order to stay with this company."
(all: 1 = strongly disagree to 4 = strongly agree)

Work Group Quality

"How would you rate the overall quality of work done in your work group, department, or section?"
(1 = not good at all to 5 = excellent)

Note that only bundle operators belong to departments or sections (e.g., pocket setters, leg elastic); modules and mini-lines have work groups.

Independent Variables

Work Organization

Job Design Variables

Autonomy

"How much are you able to influence how the garment is assembled?"
(1 = not at all to 4 = a lot)

Identity

"How much are you able to influence decisions about the specific tasks or work assignments that you perform?"
(1 = not at all to 4 = a lot)

Variety

"How many different operations can you do?"
(1 = one, 2 = a few, 3 = several, 4 = many)

Table 1b (cont.)**Significance**

"My job makes good use of my knowledge and skills."
(1 = strongly disagree to 4 = strongly agree)

Workload/Stress

"The amount of stress you feel at work has increased over the past 2 years."
(1 = strongly disagree to 4 = strongly agree)

Human Resource Management

Off-line Participation: is a scale formed from the following:

"Except for union meetings, do you meet with other people away from your work area to improve product quality?"

"Except for union meetings, do you participate in a committee with other workers and managers to discuss training?"

"Except for union meetings, do you participate in a health and safety committee?"

"Except for union meetings, do you meet with people from other departments or sections to solve production problems."

"Except for union meetings, do you meet with people away from your work area to work on solving any other kinds of problems?"

(all: 0 = no, 1 = yes)

Training

"In the last two years, has this company provided you with any classroom training or other formal training away from you work area?" Categories of training are:

- a) basic skills in reading or math
- b) interpersonal skills in communication or working together
- c) quality improvement skills in problem-solving or statistical process control
- d) group skills for working in teams or making decisions
- e) skills related to your specific job
- f) other

(0 = no, 1 = yes)

Advancement Opportunity

"How satisfied are you with the training opportunities you have at your company?"
(1 = very dissatisfied to 4 = very satisfied)

Compensation**Earnings**

"How much do you earn in a typical week from your job at this company, before taxes or other deductions?"

Pay Satisfaction

"How satisfied are you with the fairness of your pay?"

Table 1b (cont.)

(1 = very dissatisfied to 4 = very satisfied)

Employment Security

"Think about a situation in which sales decline at your company. In this case, will your company make a special effort to avoid layoffs?"

(0 = no, 1 = yes)

Employment Relations**Labor-Management**

"In general, how would you describe relations in your workplace between management and employees?"

(1 = very bad to 5 = very good)

Co-worker Relations

"In general, how would you describe relations in your workplace between co-workers in this plant?"

(1 = very bad to 5 = very good)

Union Affiliation

"Are you covered by a union contract?"

(0 = no; 1 = yes)

Demographics**Age**

"What year were you born?"

(recoded to number of years old)

Female

"What is your sex?"

(0 = male, 1 = female)

Race

"Which racial or ethnic group describes you best?"

(recoded to 0 = white non-Hispanic; 1 = other race or ethnic group)

Tenure

"In what year did you first begin working for this company?"

(recoded to number of years with company)

Table 1b (cont.)

Education

"What was the highest level of schooling you completed?"

0 = none

1 = grade school (1-8) (recoded to 6)

2 = some high school (9-11) (recoded to 10)

3 = high school diploma or equivalent (GED) (recoded to 12)

4 = some college or community college (recoded to 14)

5 = 4 year college degree (recoded to 16)

6 = more than college (recoded to 18)

Table IIa
Means of Variables for Telecommunications Groups

Variable	Network Craft		Customer Service	
	Self Managed	Trad. Managed	Self Managed	Trad. Managed
<u>Dependent Variables</u>				
Job Satisfaction	4.000***	3.620	3.352	3.250
Org. Commitment	3.911**	3.760	4.048*	3.882
Group Quality	4.402***	4.150	4.472***	4.140
<u>Independent Variables</u>				
Job Design				
Autonomy	3.394***	2.767	2.465***	2.168
Identity	3.267***	2.743	3.529	3.358
Variety	3.693***	4.900		
Significance	3.924***	3.606	3.634	3.597
Workload/Stress	3.482*	3.293	3.675	3.720
Human Resource Mgmt.				
Off-line Particip.	0.615**	0.425	0.621	0.653
Days of training	9.757***	6.434	9.806	8.721
Advancement Oppor.	3.013***	2.658	3.238	3.115
Compensation				
Earnings (yrly)	41,309**	43,379	32,724*	32,766
Pay satisfaction	3.910	3.878	3.920	3.896
Employment security	2.063	1.984	2.138	2.094
Employment relations				
Labor-management	3.357**	3.164	3.311	3.161
Co-worker	4.243***	4.036	4.492**	4.337
Union affiliation	0.873	0.873	0.818	0.812
Demographics				
Age (years)	46.017*	45.072	41.573	40.475
Female	0.266	0.213	0.951*	0.892
Race	0.219	0.219	0.257	0.243
Tenure (years)	23.399*	22.574	19.301**	17.392
Education (years)	13.021	12.973	13.049*	13.350

* significant difference between self vs. trad. groups at 10% level

** significant difference at 05% level

*** significant difference at 01% level

Table IIb
Means of Variables for Apparel Workers

	Bundle	Module	Mini-Line
<u>Dependent Variables</u>			
Job Satisfaction	3.01	3.02	3.00
Organizational Commitment	2.73	2.70	2.91bc
Work Group Quality	3.33	3.79ac	3.39
<u>Independent Variables</u>			
Job Design			
Autonomy	2.55	3.11ac	2.57
Identity	2.25	2.84a	2.73
Variety	2.31	3.35ac	2.67
Significance	2.68	2.86a	2.71
Workload/Stress	2.97	3.25a	3.14
Human Resource Management			
Off-line Participation	0.61	0.90a	0.87
Training	0.37	0.58a	0.76bc
Advancement Opportunity	2.55	2.82a	2.73
Earnings (weekly)	270.53	271.40	290.22c
Pay Satisfaction	2.65	2.55	2.45
Employment Security	0.76	0.88a	0.84
Employment Relations			
Labor-Management	3.40	3.67ac	3.33
Co-Worker	2.20	2.39	2.14
Union Affiliation	0.83ab	0.44	0.14
Demographics			
Age	37.22b	36.29	33.39
Gender	0.92b	0.94c	0.79
Race	0.16	0.16	0.71bc
Tenure (years)	8.17a	5.41	9.10c
Education	11.61	11.61	11.31

a = Bundle vs. module significantly different at $p < .05$

b = Bundle vs. mini-line significantly different at $p < .05$

c = Module vs. mini-line significantly different at $p < .05$

Table IIIa
Determinants of Job Satisfaction:
Craft Workers, Office Workers, Sewing Machine Operators!

Variable	Network Craft	Customer Service	Sewing Machine Op.
<u>Work Organization</u>			
Work groups			
Self-managed	.059 (.214)	.029 (.231)	-.341 (.247)
Mini-lines			-.223 (.361)
<u>Job Design</u>			
Autonomy	.449*** (.123)	.280*** (.114)	-.121 (.106)
Identity	.185* (.101)	.243** (.114)	.386*** (.118)
Variety	.016 (.038)		-.204* (.119)
Significance	1.100*** (.110)	.871*** (.110)	1.042*** (.158)
<u>Off-line Participation</u>	.133 (.117)	-.145 (.129)	.142 (.094)
Pseudo R-squared	.189	.135	.095
Prob > chi2	.000	.000	.000
Sample Size	N = 399	N = 302	N = 455

For this and subsequent tables:

* significant at .10% level

** significant at .05% level

*** significant at .01% level

() standard errors in parenthesis

! controls for demographics (age, race, gender, education, and company tenure) not shown.

Table IIIb
Determinants of Organizational Commitment
Craft Workers, Office Workers, Sewing Machine Operators

Variable	Network Craft	Customer Service	Sewing Machine Op.
<u>Work Organization</u>			
Work groups			
Self-managed	-.055 (.075)	.125 (.086)	-.455** (.220)
Mini-lines			.941*** (.325)
Job Design			
Autonomy	.038 (.041)	.032 (.042)	.084 (.094)
Identity	.118*** (.035)	.147*** (.041)	.303*** (.101)
Variety	.009 (.013)		-.152 (.105)
Significance	.298*** (.033)	.276*** (.037)	1.164*** (.133)
<u>Off-line Participation</u>	.064 (.041)	-.051 (.047)	.161 (.083)
Constant	.789 (.544)	1.645*** (.561)	13.37*** (.913)
Adjusted R-square	.344	.253	.241
Sample Size	N = 400	N = 322	N = 447

Table IIIc
Determinants of Perceptions of Work Group Quality
Craft Workers, Office Workers, Sewing Machine Operators

Variable	Network Craft	Customer Service	Sewing Machine Op.
<u>Work Organization</u>			
Work groups			
Self-managed	.519** (.217)	1.224*** (.250)	.999*** (.231)
Mini-lines			.244 (.334)
<u>Job Design</u>			
Autonomy	.054 (.122)	.013 (.116)	.061 (.098)
Identity	.106 (.103)	-.095 (.114)	-.071 (.105)
Variety	.013 (.019)		.069 (.109)
Significance	.394*** (.100)	.357*** (.109)	.224 (.139)
<u>Off-line</u>			
Participation	.125 (.121)	-.142 (.130)	.099 (.087)
Pseudo R-squared	.055	.078	.095
Prob > chi2	.000	.000	.000
Sample Size	N = 398	N = 302	N = 455

Table IV
Determinants of Job Satisfaction:
Craft Workers, office Workers, Sewing Machine Operators!

Variable	Network Craft	Customer Service	Sewing Machine Op.
<u>Work Organization</u>			
Work groups			
Self-managed	.016 (.245)	.095 (.279)	-.164 (.281)
Mini-lines			.049 (.422)
Job Design			
Autonomy	.428*** (.137)	.071 (.139)	-.161 (.116)
Identity	.075 (.115)	.116 (.141)	.225* (.128)
Variety	-.030 (.047)		-.081 (.129)
Significance	1.045*** (.129)	.906*** (.142)	.656*** (.183)
Workload/Stress	-.259*** (.099)	-.080 (.128)	-.337** (.145)
<u>Human Resource Mgmt.</u>			
Off-line Particip.	.125 (.130)	.049 (.158)	.033 (.106)
Training	.009 (.011)	.003 (.013)	-.006 (.242)
Advancement Oppor.	-.048 (.109)	.171 (.121)	.629*** (.176)
Compensation			
Earnings	.000 (.000)	-.000** (.000)	.002 (.002)
Pay satisfaction	.251** (.109)	.417*** (.128)	.830*** (.170)
Employment security	.439*** (.134)	.397** (.169)	.159 (.297)
<u>Employment relations</u>			
Labor-management	.387*** (.150)	.319* (.167)	.419*** (.143)
Co-worker	.239* (.138)	.007 (.201)	.570*** (.126)
Union affiliation	-.282 (.346)	-.247 (.348)	.144 (.276)
Pseudo R-squared	.262	.199	.254
Prob > chi2	.000	.000	.000
Sample Size	N = 364	N = 239	N = 459

! For Tables IV, V, and VI, controls for demographics (for all groups), and technology and working conditions for telecommunications groups, not shown.

Table V
Determinants of Organizational Commitment
Craft Workers, Office Workers, Sewing Machine Operators

Variable	Network Craft	Customer Service	Sewing Machine Op.
<u>Work Organization</u>			
Work groups			
Self-managed	-.032 (.079)	.083 (.096)	-.525** (.225)
Mini-lines			.690** (.342)
Job Design			
Autonomy	-.011 (.043)	.032 (.048)	.054 (.094)
Identity	.085** (.037)	.075 (.048)	.218** (.102)
Variety	.001 (.015)		-.146 (.104)
Significance	.197*** (.038)	.176*** (.045)	.861*** (.140)
Workload/Stress	-.032 (.032)	-.025 (.046)	-.067 (.113)
<u>Human Resource Mgmt.</u>			
Off-line Particip.	.052 (.043)	.007 (.052)	.065 (.085)
Training	-.002 (.003)	.004 (.004)	.303 (.194)
Advancement Oppor.	.081** (.034)	.193*** (.043)	.502*** (.137)
Compensation			
Earnings	.000 (.000)	-.000 (.000)	.001 (.001)
Pay satisfaction	.076** (.036)	.069 (.045)	.370*** (.126)
Employment security	.064 (.043)	.047 (.057)	.328 (.237)
<u>Employment relations</u>			
Labor-management	.133*** (.046)	.104* (.056)	-.059 (.111)
Co-worker	.009 (.045)	-.007 (.071)	.182* (.098)
Union affiliation	-.082 (.112)	-.105 (.124)	-.306 (.221)
Constant	.882 (.627)	.954 (.789)	10.89*** (1.174)
Adjusted R-square	.344	.354	.315
Sample Size	N = 365	N = 240	N = 434

Table VI
Determinants of Perceptions of Work Group Quality
Craft Workers, office Workers, Sewing Machine Operators

Variable	Network Craft	Customer Service	Sewing Machine Op.
<u>Work organization</u>			
Work groups			
Self-managed	.477* (.256)	1.455*** (.304)	1.255*** (.257)
Mini-lines			.591 (.385)
Job Design			
Autonomy	.003 (.145)	-.111 (.144)	.085 (.107)
Identity	.096 (.122)	-.366** (.150)	-.114 (.115)
Variety	.045 (.049)		.123 (.116)
Significance	.197 (.137)	.139 (.155)	.041 (.166)
Workload/Stress	-.102 (.104)	.010 (.138)	.135 (.128)
<u>Human Resource Mgmt.</u>			
Off-line Particip.	.218 (.141)	-.093 (.164)	.102 (.096)
Training	-.020*** (.010)	.006 (.013)	.536** (.221)
Advancement Oppor.	.010 (.109)	-.030 (.139)	-.036 (.157)
Compensation			
Earnings	-.000 (.000)	-.000 (.000)	-.001 (.002)
Pay satisfaction	-.072 (.118)	.158 (.141)	.134 (.146)
Employment security	-.298** (.142)	.274 (.179)	.239 (.268)
<u>Employment relations</u>			
Labor-management	-.108 (.152)	.289 (.179)	.084 (.127)
Co-worker	.899*** (.153)	.618*** (.224)	.284*** (.115)
Union affiliation	.671** (.364)	.771** (.370)	.867*** (.252)
<u>Mediating Variables</u>			
Job Satisfaction	.111 (.152)	.255* (.150)	.194 (.178)
Org. Commitment	.558*** (.186)	-.090 (.218)	.020 (.055)
Pseudo R-squared	.173	.151	.079
Prob > chi2	.000	.000	.000
Sample Size	N = 362	N = 238	N = 433

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Endnotes

ⁱ Batt conducted the telecommunications study in 1993 and 1994 to complete dissertation research under the auspices of the MIT Industrial Performance Center and with additional financial support from the Alfred P. Sloan Foundation, the National Telecommunications Research and Policy Consortium, and Coopers and Lybrand. For the full study, see Batt (1995). Appelbaum conducted the apparel study in 1994 in conjunction with Tom Bailey, Peter Berg, and Arne Kalleberg, under the auspices of the Alfred P. Sloan Foundation. See Appelbaum, Bailey, Berg, and Kalleberg (1994) for a full report.

ⁱⁱ Autonomy refers to the degree to which the job provides substantial freedom, independence, and discretion in work scheduling and procedures. Variety is the extent of variety of different activities and skills. Task identity is the degree to which a job requires completion of a whole and identifiable piece of work. Significance is the extent to which the job has a significant impact on other people. Feedback is whether the job provides direct and clear information about performance effectiveness (Hackman and Oldham 1980:78-80).

ⁱⁱⁱ Historically, telephone companies did not allow I&R workers to "double up" because it was considered inefficient. Workers who couldn't solve a problem had to go back to the office and get their supervisor who then came out and looked at the job before deciding what to do.

^{iv} The following comments from workers reflect these conflicts: "We are asking for the responsibility to be a self-directed team. But the supervisors won't let go. The supervisor still makes the decision and we do the paper work. We're not invited in on decisions made by the supervisor. She decides overtime; we can't set our work schedule. She sets the vacation schedule for all of us [in both traditional and self-managed groups] So she basically treats the traditional and self-directed groups the same" (Batt 1995).

^v One member of a self-directed team reported:

"I like the small group... people give you a sense of community. The disadvantage is that you feel more responsible for the job The advantage is that we have more freedom, no supervisor standing over our shoulder. There's the satisfaction in handling problems on our own. For example, sales dropped once and the we figured out how to correct it."

Another worker reported:

"As for our work, it's not that different. The difference is that we work together. If I need help with an order, my teammates will help me so we get everyone's work done at the same time. We're family.... We work differently because of the training and team building we received. We make sure we're here at 8 am We now have the right to call different departments -marketing reps, frame engineering. Now we decide who among us handles special projects. Now we're also in on coordinators meeting and conference calls. But we've had to fight to get all of this" (Batt 1995).

^{vi} We do not include feedback (as well as variety for service workers) for lack of accurate measures of these dimensions.

^{vii} Unfortunately, a unionized module plant originally selected for this study had to be dropped from the initial survey because employees are Spanish-speaking. The survey instrument is currently being translated into Spanish, and these workers will be surveyed in the next round of the study.

^{viii} Whereas the index of commitment for apparel workers is based on six questions, that of telecommunications workers is based on three because only three questions factored appropriately. See Table 1 for a list of definitions.

^{ix} In qualitative interviews, some teams said they preferred to let team members volunteer for the jobs that they did best, and a "natural" division of labor occurred.

^x Ordered or multinomial logits are estimated via a maximum likelihood technique; they are used because the dependent variables job satisfaction and group quality are measured by 5-item (multinomial) scales; ordered logits (probits) estimate the probability of making a choice between items on a scale. The logit and probit models differ in their assumptions about the error term. Logit models assume that the error terms are independently and identically distributed; this means that it does not distinguish between alternatives that are close substitutes. Probit models assume that error terms are distributed multivariate-normally, allowing error terms to be correlated across alternatives thereby allowing more accurate distinctions across similar alternatives. We tested both logit and probit models in our study, and did not find significant differences in coefficients or levels of significance. We report logit results here. We used regression analysis for the commitment model because the commitment index is based on multiple questions and therefore takes on a continuous scale.

^{xi} These models include controls for telecommunications workers with respect to technology and service markets. We do not report the results of these controls for lack of space.

^{xii} The dependent variables for telecommunications and apparel workers were slightly different. Telecommunication workers were asked, "how satisfied are you with your participation in decision-making?" Sewing machine operators were asked whether "workers have the opportunity to discuss major decisions before they are put into practice."