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INTRODUCTION OF QUALITY-DRIVEN TEAM-BASED SYSTEMS: ISSUES AT THE BOUNDARY of OPERATIONS MANAGEMENT AND INDUSTRIAL RELATIONS

by

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Introduction of Quality-Driven Team-Based Systems:

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Abstract

In order to improve the quality of their products many American corporations have begun to shift the emphasis of the organization of production from detection of defects to improvement of the production process. Most quality improvement programs emphasize employee involvement and team work in problem-solving and execution of day-to-day tasks. Based on the experiences of a set of companies, we explore the impact of teams on process improvements. Potential benefits from introducing team-based systems lie in the productive use of workers' knowledge and expertise. The introduction of teams also has the effect of partitioning the tasks of an organization: the proper partitioning of tasks can enhance organizational control and reduce coordination and monitoring costs.

The introduction of teams changes the nature and scope of supervision and requires flexibility in reassigning work among team members. We discuss the impact of these changes on managers, workers and unions. Most notably, the new work arrangements shift some of the previous domain of management control to the teams and undermine the basis of the traditional system of job-control unionism. Major concerns of the unions are that workers are not fairly compensated for the extra effort or knowledge they contribute under team-based systems, that employers will cut employment in response to worker-inspired efficiency gains, and that teams will undermine union solidarity. As most of our field observations are based in the aerospace industry, we discuss the specific responses of the two leading unions in this industry.

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1. Introduction

During the 1980s many American corporations were reorganized to restore their competitive positions. A central element in this change was an increased emphasis on quality. For several decades quality was associated with inspection and ensuring that the output conformed to specifications. In the 1980s a major change occurred with a shift in emphasis from *detection* of defects to *prevention* of defects. This was accomplished by improving the production process. Obvious consequences of process improvements are products that more closely conform to nominal specifications and a reduction in the number of defects. Process improvements can also result in substantial cost reductions, increased productivity, and shorter manufacturing lead times. Customer satisfaction, the final barometer of most quality improvement efforts, depends not just on the nominal specifications of the product but also on the cost, the delivery schedule and the general responsiveness and reliability of the firm.

It is now widely recognized that continuous improvement of production processes cannot be accomplished by traditional quality departments alone, but requires the involvement of almost all the other functional areas. To effectively improve a process and increase customer satisfaction the involvement of personnel from manufacturing, quality control, industrial engineering, maintenance, purchasing, design, marketing etc. is necessary. The involvement of line workers who posses specific knowledge of the production process is also crucial. In order to constructively engage these different groups in improvement activities, firms are reorganizing.

Reorganization efforts are occurring at two levels. At the macro level, the structure of the entire organization is being modified. In many cases functional specialization is being replaced by customer (or product) focus as the basis for organizing the activities of the enterprise. In addition to this restructuring at the top, changes are also being made at lower levels of the organization (the micro level). Line workers are being organized in teams that are collectively responsible for a set of tasks that relate either to a small set of products or to specific processes.

In this paper, we are concerned with the introduction of work teams. We study the scope of the tasks and the responsibilities delegated to the teams, as well as the impact of teams on process improvements. We observe that the formation of work teams is often accompanied by a change in the degree of autonomy exercised by workers as well as the degree and the nature of supervision that they are subject to. Thus this reorganization of

work is having an effect on management, line workers, and labor unions. We discuss how the introduction of team-based work systems affects these three parties.

This paper is based upon the experiences with work reorganization of two aerospace firms (5 different plants) and an electronics manufacturer. In five of these sites the work force is unionized. All of these plants are in the early stages of implementing the team concept: almost all of them began their reorganization efforts four years ago. The next section contains a brief description of the changes in one of the aerospace companies and the electronics manufacturer.

In our field study we observed different types of work teams. There were differences in the sizes of teams, the basis on which the teams were constructed (product based or process based), the degree of and the nature of external supervision teams were subject to, the performance measures and incentive schemes, and the types of improvements that have resulted from the reorganization. These differences give rise to questions of how and why the introduction of work teams impacts product quality, product costs and manufacturing lead times. If teaming is viewed as a way of partitioning tasks in an organization, then on what basis should the firm partition tasks, assign them to teams, and monitor their performance?

In section 3 of this paper we discuss a framework for analyzing team design. We first introduce the basic concepts of Taylorism that have shaped the organization of work in many industries as well as unionized industrial relations in the US. during this century. Under this scheme, the work that is performed in an organization is divided into narrow tasks, these tasks are assigned to various individuals, and their execution is controlled and coordinated by a hierarchy of supervisors and managers. In team-based work systems these narrow tasks are aggregated and assigned to teams that are given certain discretion over their execution. Introduction of teams is bringing some autonomy into the hierarchical control structure of the classical Tayloristic firm.

The scope of a team's activities and responsibilities is likely to be determined by (i) considerations of coordination and control of the team's activities, and (ii) the ability of the team to effectively utilize the specific knowledge and skills of its members.

In section 4 we pursue the control and coordination perspective of work design. Aggregation of tasks and their assignment to teams determines the team boundaries. The combined output of the team becomes the control point for the larger organization. The

team output can also be the basis for performance evaluation. As aggregation increases, it is easier to align the goals of the teams with the overall goals of the firm and to measure and monitor the combined output of the team. On the other hand with task aggregation, it becomes increasingly difficult to link individual performance to what is being measured and to externally coordinate activities within the team. Fragmentation of tasks has cross-cutting consequences. As fragmentation increases, the firm has greater insight into individual actions of employees. But with fragmentation, coordination and monitoring become more costly and alignment of individual tasks with the goals of the firm becomes increasingly difficult. Teams might be designed so as to balance these conflicting objectives.

An observation in this paper is that aggregating tasks for teams rather than individual workers can improve the way in which quality requirements are defined, eliminate intermediary inspections, and reduce the costs of coordination and control within an organization. Teaming can also improve coordination of the tasks inside the boundaries of the team due to shorter information paths and greater utilization of workers' capabilities.

In section 5 we examine the consequences of expanding the domain over which the workers can apply their specific knowledge and expertise. An important aspect of the discussion in section 4 is the need to control and monitor the activities of the team and its members. The discussion is consistent with assumption that individuals seek to maximize their own welfare (in the neoclassical economic sense, with work providing disutility) and that the objective of organizational design is to ensure that individuals acting in their own interests thus defined contribute to the overall goals of the organization. An alternative behavioral assumption is that workers are intrinsically committed to their work and monitoring therefore is unnecessary or of secondary importance. Under this assumption, the boundaries between teams should be based on the decision domain over which workers can most effectively utilize their expertise. We argue that many of the process improvements that we observed stem from the wider application of the knowledge and creativity of the work force. In many cases the improvement efforts were voluntarily undertaken by teams despite obvious adverse economic consequences for the team members.

Sections 4 and 5 describe the benefits that accrue to the firm from the introduction of teams. There are, however, significant questions related to how the benefits will be distributed between different stake holders and the likely responses of the workers and

unions. There are many behavioral and institutional factors that have to be taken into account to adequately understand these responses. In order to discuss the positions of the labor unions regarding work reorganization we distinguish between teams, worker empowerment, and continuous improvement. We make this distinction because these three concepts have different implications for workers and unions.

Teams are in general more effective if there is flexibility in redistributing the work among team members. Flexibility in assigning work usually requires a reduction in the number of job categories and less precise job descriptions. This is particularly problematic in the context of the post-war US. unionized industrial relations system because of the importance of the concept of a job as an organizing principle in this system. The well defined and finely divided job is the basis for defining the boundaries of managerial discretion (and thus the rights of workers) as well as pay rates. Obviously, the destruction of the basis of a well-established system of labor relations can lead to concerns on the part of the unions and the workers, particularly when the change is seen as a substitution of *trust* between labor and management for well defined and instituted *rules*.

Continuous improvement is even more contentious. Increases in labor productivity can occur in two ways which are not necessarily mutually exclusive. First, changes in work methods, work organization, or product or process technology can lead to an increase in output for the same level of effort. Second, increases in labor productivity may also arise due to increased effort. A common objection to continuous improvement programs is that they amount to management by stress. In the plants we visited, the workers did not participate in the setting of standards, though this practice does occur elsewhere.

Empowerment usually means that the workers make decisions regarding production schedules, training, and resource allocation. These decisions were earlier made by supervisors. Also, improvement in quality and productivity may come about because workers are now involved in tasks which were performed earlier by engineers. Thus, worker empowerment in team-based systems entails expansion of workers' tasks to include activities that were performed earlier by personnel with higher wages. If the workers are working smarter, are they fairly compensated for the extra knowledge they contribute?

In section 6 we discuss the complex set of concerns on the part of the unions: that

the workers are not fairly compensated for either the extra effort or the extra knowledge they are asked to contribute to produce the gains, that they are being induced to work themselves (or their fellow workers) out of their jobs, that employers will take advantage of the new latitude they receive with the weakening of job-control unionism, and that teaming amounts to company-dominated unionism which is both illegal in the US. and, in the view of the unions, inimical to the ultimate interests of the workers. In particular, we outline the position of the two leading unions in the aerospace industry.

Finally, in section 7 we briefly discuss some possible behavioral responses of workers that do not fit into the rational/opportunistic model underlying the analysis in section 4. We summarize our findings and conclude in section 8.

2. Reorganization Efforts: A Study of Two Plants

To understand the impact of teams it is necessary to understand the larger context in which teams operate. The prevailing state of the industry, the relationship among workers, unions and management, and how the changes in organization were introduced are some of the factors that have a significant bearing on the success of work reorganization. We briefly describe these contextual aspects for two sites that we feel best illustrate the changes that are being undertaken. The insights we discuss in the remainder of this paper are also based to a large extent on our observations of the experiences of these two sites. One of the plants is in the aerospace industry and the other plant is in the consumer electronics industry. The two cases, based in significantly different business environments, also illustrate the diversity in how the team concept is being employed.

2.1 Plant A: Aerospace Plant

2.1.1 Business Environment

The aerospace plant specializes in the production of sheet metal parts that form the structure of an aircraft. These parts are shipped to various manufacturers of commercial and military aircraft. The plant has seen dramatic changes in recent years in both its commercial and military markets.

In commercial aerospace, airline deregulation has caused a significant shift in the behavior of the company's potential buyers. While a decade ago, product

characteristics and delivery time used to be the determining factors of the company's success, price competition seems to dominate today's market. The trend has been exacerbated by the globalization of the aerospace industry, emergence of aggressive foreign competitors, and indications that the US. manufacturers of commercial aircraft will begin to offload work to countries that buy their planes. On the military side of the market, the end of the cold war and consequent budget cuts have shrunk demand for the products. In addition, over the last two decades changes in government procurement contracting procedures have put even more pressure on the company to reduce costs. (See Erickson [1994] for further discussion and analysis of these changes on the commercial and military sides of the industry.)

The plant's main business at the time of our field work was the production of aero-structures for a commercial aircraft manufacturer. In addition, the plant has some defense contracts. Present sales are $177 million per year, and the number of employees is 2000, 1000 of which are salaried, and 1000 hourly wage. Almost all the hourly employees belong to the union. Significant layoffs are considered to be imminent, primarily in the sheet metal fabrication area.

Employment in the plant peaked at 5000 in 1988 due to a lucrative government program. At that time, the plant was supplying sheet metal parts to other plants of the same company. Consequently, the plant did very little marketing on its own and lacked a customer orientation. Once the program ended, and significant cuts were made in defense spending, management realized that the plant had to further develop its commercial business. In 1988-89, bids on a number of commercial contracts were submitted with very little success. The primary cause of this failure was thought to be high costs. Thus the need to cut costs was the primary driver behind the changes that the company embarked upon.

2.1.2 Introduced Changes

Functional orientation of the organization of the plant was not problematic until efforts to cut costs exposed its weaknesses. Instead of looking for internal reserves and coming up with creative solutions in the face of diminishing budgets, each function from operations support to maintenance and facilities responded by cutting back on the services provided to the manufacturing line. Functional divisions were also thought to be very unresponsive and slow. Hence, the first major step that the management undertook was to change the organizational structure

from a functional orientation to a customer/product orientation. The government and commercial parts of the business were separated. The new organization structure was developed in six months after carefully studying the major operations.

At the same time, a policy decision was made to create a team-based organization at the shop floor level. The contract with the union was re-negotiated in an attempt to develop a partnership relationship. Tactical decisions related to the actual size and scope of different teams were made later. These decisions were made on a decentralized basis as and when teams were introduced in the different sections.

In the past, management operated under the assumption that, due to the cyclical nature of the aerospace business, frequent hiring and layoffs were inevitable. Consequently, it chose to under-invest in labor training and opted to simplify the tasks. Labor was thereby viewed as freely interchangeable and a variable cost. With the change in corporate strategy which now requires the workers to contribute more, the management has decided to spend more on training.

2.1.3 Characteristics of Work Teams

Teams have been extensively used in two production areas: assembly and bonding. While the teams in the assembly area are organized on the basis of products, in the bonding area they are process-based. All together there are forty teams and each team consists of ten to fifteen employees.

In the assembly area, there are fifteen teams, each producing a different product. Most of these products are very complex and require considerable expertise to assemble. For example, an aircraft door has 300 sheet metal pieces that are contoured and have to be precisely riveted. There are several thousand rivets in each door. A sheet is scarred if it is either improperly bent or inaccurately drilled. Any scarring is considered unsafe and it results in expensive rework. Workers working on each product have developed substantial product-specific expertise and as a result the teams are organized around each product.

In the commercial bonding area beams for aircraft structures are produced using graphite composite materials. The production process involves laying several layers of graphite sheets on top of one another. These sheets are then bonded and cured to become the composite beam. The composite beam is further machined

and other components are attached to the machined beams. The bonding area is more process/machine intensive than the assembly area, and can be characterized as a job shop. It is fairly easy for an operator to switch from one product to another. Because there is an opportunity to develop some expertise on each machine/process stage, this area is divided into teams based on the processing steps.

At present, the fabrication/tools group is expanding very rapidly. Its strength has increased from 80 to 350 in one year, overtime is running at 100%, and further growth is anticipated. Due to the hectic pace of the work management is reluctant to introduce teams in this area. This rapid growth is affecting teams in other areas. Due to the union bidding process in which new job openings are filled according to seniority and without input from management, many workers are moving from other areas to fabrication/tools. Since bidding occurs on a monthly basis the composition of the work teams in other areas changes almost every month.

Monitoring and incentives

In the areas where teams have been introduced, the level of supervisory involvement has diminished and each team now has some flexibility in scheduling its internal tasks. Two teams are operating without a supervisor. The teams meet a supervisor periodically to address administrative issues that lie outside the domain of the team. In general, the role of supervisors is changing: they are now expected to assist rather than supervise teams.

There are no formal mechanisms in place for mutual monitoring or evaluation among team members. For each task there continues to be standard times against which the performance is measured. It appears that the significant change of introducing teams as a way of organizing work has not been accompanied by a corresponding change in performance measurements, incentives and rewards.

Decision Making Domain

At the outset of the program, there were some misconceptions about the nature of the changes that were going to be implemented. The workers were under the impression that empowerment meant that they could decide issues such as: their work schedules, over-time hours, vacation time, location of vending machines in the shop, etc.

However, the decision making domain turned out to be more constrained. Standard hours for each task are determined jointly by the union and management, and not by the team. The standards determine the number of workers assigned to each team. The team is expected to meet a delivery schedule that specifies the number of units to be produced each shift. Team members schedule and coordinate tasks inside the team boundary. They are collectively in charge of the quality of the team output. Quality control in the plant takes the form of visual detection for many of the products. It has been noticed that teams tend to eliminate formal intermediary inspection steps (that fell within the team boundaries), inspecting only the final product.

2.1.4 Union and Worker Responses and Observed Improvements

From the very beginning, management involved the union representatives in the reorganization. This has created some trust and a generally positive atmosphere. Union leaders believed that the 25% reduction in managerial staff was a significant sacrifice on the part of the management and was a fair way of sharing the burden of cost reduction. They also thought that top and middle management have made considerable progress in being more accessible to the union representatives.

The union leaders felt, however, that line workers are still not well informed about the nature and direction of the changes. They believed that workers should be better informed about the financial status of the plant, possibilities of layoffs, and status of new business. In the absence of such information, union leaders were concerned that paranoia on the shop floor could be fueled by false rumors of plant closures. Management concurs with this view and believes that truthfully revealing good and bad developments in a timely fashion is important for employee morale. In the past, it was felt that revealing bad news would harm morale. To remedy the communication problem, the union plans to hold mandatory weekly stand-up meetings to discuss business changes. In addition, a plan is under way to bring out a newsletter for the workers.

Individual worker responses to the new system have not been formally surveyed. Management and union leaders believe that a majority of the line workers, despite being skeptical about the change, prefer the new work organization. However, some workers who are highly experienced and skilled but

lacking in literacy skills feel threatened and exposed by the new emphasis on classroom learning, job rotation, and training in statistical process control.

Since the introduction of teams a number of significant process and technological improvements have occurred, in both the assembly and bonding areas. In addition, in some parts of the production process constant improvements in productivity have been observed. We describe these improvements in sections 4 and 5.

2.2 Plant B: Electronics Manufacturing Plant

2.2.1 Business Environment

Company B is a successful electronics manufacturer whose work force is not unionized. Notably, the company has not experienced any immediate competitive pressure to reorganize. The value added in the manufacturing plant represented less than 5% of the total value of the product. However, the manufacturing line is important for product development and design. Employment levels at the plant have not changed in the last four years. Employee turnover is low, likely due to the company's policy of competitive salaries. Many workers have worked at this plant for over a decade.

The company started changing the way it organizes operations in 1988. The move was championed by a new production manager at the third highest hierarchical level in the organization, below the site general manager. It was felt that the introduction of work teams would result in increased feelings of ownership and responsibility, as well as new opportunities for personal growth of employees. This in turn would translate into long term competitiveness for the company through a more productive, skilled, and flexible work force.

2.2.2 Introduced Changes

The organizational change has been guided by the principle that decisions should be made at the same place where the problems occur. The new organization seeks to delegate to work teams tasks and responsibilities that are believed to be more efficiently controlled by them. This is expected to make it possible for the management to focus on the overall performance and setting the right goals for teams. At the same time, greater autonomy for teams in planning and scheduling work tasks, vacations, and training is expected to create a friendlier environment. The changes in the organizational structure are shown in Figure 1.

Relatively highly paid supervisory jobs were eliminated through the reorganization. Some of the supervisors chose early retirement, some became technicians in maintenance and other services, while others became members of newly formed work teams.

Each team is assisted by a set of coaches belonging to different staff functions

such as manufacturing engineering, quality, finance and production planning. Coaches provide technical assistance. The performance of the coaches is assessed based on evaluations provided by the teams, management, and the rate at which teams make progress.

2.2.3 Characteristics of Work Teams

Before the final team design that is shown in Figure 2 was chosen, as many as thirty six alternatives were considered. The production workers were divided into seven teams. Five teams are in the final assembly area, and there are two subassembly teams. Although management believes that team size should not exceed twenty five, at present some of the teams are much larger -- some have over 100 members. Overall, the team concept is still in its early stages. The company expects to eventually break up the larger teams.

In this plant, the process of introducing teams is very formal. Teams establish their team charters and bylaws that regulate internal interactions and relationships. These documents are in accord with a company-wide charter that defines general rules for the team work.

Monitoring and incentives

One of the team activities is a twice a year mutual evaluation of team members in terms of safety, quality, productivity, team work, and any other issues that may be found pertinent. Marks for each of these criteria range from 0 for unacceptable to 5 for high. These evaluations do not affect individual pay, and they are meant to identify opportunities for improvement. The only situation in which the management steps in and gets involved directly is when an unacceptable 0-rating appears on an employee's evaluation sheet.

Team performance is measured daily using a set of metrics that include quality, cost, delivery on schedule, and safety. The cost is measured in units/person/day against norms preset by the management. Any persistent discrepancies between teams in this respect are corrected by reallocating workers among teams. Quality has to satisfy centrally prescribed levels and it is controlled by the team members and by representatives from other teams. This control mechanism is based on trust and it does not incorporate prevention of cheating or collusion. The metric that deals with meeting the schedules punishes linearly any

production below or above the centrally planned quantity.

The pay of each team member depends on how the entire team performs with respect to the metrics described above and on individual merits. A comprehensive individual merit scheme that is in preparation will be based on workers' skills and the number of work stations that they can operate. This scheme will be designed to motivate workers to maintain their old skills and acquire new certifications, thus making organization of work within a team more robust and flexible. There is a company-wide profit-sharing scheme that awards annual bonuses proportional to the employees' yearly earnings.

Decision Making Scope

Teams have taken over most of the tasks that supervisors used to perform in the old system. Responsibilities of a previous supervisor are broken into tasks that are assigned to different coordinators within the team. The engineering coordinator is responsible for updating assembly procedures and acts as a liaison with the research and development engineering and the manufacturing engineering departments. The quality coordinator responds to shipment errors and is responsible for quality reports. The scheduling coordinator monitors output, adjusts production plans, and coordinates with Master Schedule. Finally, the training coordinator is responsible for scheduling of training of the team members.

This approach of allocating the tasks of supervisors to different coordinators has the advantage of evenly distributing the work load. Also, since all these tasks are broken into digestible chunks and documented, it is possible to rotate coordinators every 3 to 12 months.

2.2.4 Worker Responses and Observed Improvements

Reactions of the employees to the new work design have not been formally surveyed. It is believed by management that the response is mixed, with some employees being very enthusiastic and others being indifferent or negative. There are no accurate estimates as to how much the company has benefited from the introduced changes and no dramatic product or process improvements have been reported.

3. From Taylorism to Team-Based Systems

The changes in the organization of work that we studied have a primary common characteristic. They can all be described as moves from a rigid hierarchical model of organizing work towards increased autonomy, flexibility, and responsiveness. The old model carries heavily the legacy of Frederick W. Taylor.

The work of Frederick W. Taylor between 1880 and 1910 greatly influenced the way companies in many industries are organized and managed. Taylor's work was driven by the "Machine Model" of the factory and the belief that managerial decision making should be based on proven fact rather than on tradition, rule of thumb, or personal opinion[1]. In his own words, he strove to design the work process based on "the smallest combined expenditure of human effort, material resources, and the cost of use of capital" (see Taylor [1911/1967]).

The way Taylor proposed to achieve this goal and the part of his legacy that is the most controversial today is the detailed decomposition of the production activities and the use of motion studies by experts to determine the optimal way of performing the tasks. The decomposed tasks are assigned to individual workers and their consistent performance is enforced by a hierarchy of supervisors and managers.[2] This aspect of Taylor's system was widely applied to American Industry.[3] In addition to shaping the modern industrial company, the Tayloristic concept of a well defined job somewhat ironically became the basis of the US. unionized industrial relations system, considering that Taylor himself saw no need for unions; this part of Taylor's legacy will be described in more detail in section 6.

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1 Locke [1982] provides a detailed analysis of Taylor's theories, contributions, and legacy.

2 While this practice resulted in unprecedented increases in productivity, it often led to the creation of highly alienating and over-specialized jobs (Simpson [1981]).

3 This extreme decomposition of tasks is part of the production system sometimes described as "Fordism" (Sabel[1982:32] summarizes Fordism as "the giant factory employing thousands of mainly unskilled workers and specialized machines to turn out huge quantities of a single product."). The alternatives discussed here, teaming and skill-deepening (and the associated flexibility in responding to the external market), can be part of the production systems described as "Flexible Specialization" (Piore and Sabel[1984]) or "Lean Production" (Womack, Jones and Roos[1990]).

Taylor's system can be seen as a way of partitioning the totality of the production activities into smaller blocks, allocating these blocks to individuals, and instituting systems to coordinate and monitor their performance. To illustrate the difference between Taylor's approach and the team concept, let us classify the production activities along the following three dimensions:

(1) execution of (repetitive) tasks,

(2) coordination and control, and

(2) technological innovation.

Under Taylorism the workers' jobs are highly fragmented along the single dimension of task execution. A hierarchical structure of supervisors and managers is in charge of coordination and control, and various specialists have tasks related to process improvement and technological innovation. Teaming is an alternate method of partitioning the production activities. There is an aggregation of tasks along the execution dimension, delegation of coordination and control responsibilities to line workers (to the extent that teams are empowerment to do these tasks), and involvement of workers in innovation and problem-solving. As a result, as illustrated in Figure 3, one-dimensional jobs of individual workers in the old system are replaced by three dimensional jobs of team members in the new system.

One of the consequences of the aggregation of tasks along the execution dimension is job enrichment and more meaningful work assignments. Behavioral theorists have documented the positive impact on motivation that results from this change, especially when it is accompanied by increased autonomy and power over the work environment (see Hackman and Oldham [1980], Sutton and Kahn [1987], Klein [1991], Adler [1992]). Increased motivation and commitment to the larger organization in turn can contribute to gains in productivity (Walton [1985]). However, these theories do not fully explain these gains and they are not directly concerned with the question of how the production activities should be partitioned and where the boundaries between teams should be drawn.

We argue that considerations of coordination, control and effective utilization of workers' knowledge play a significant role in determining the boundaries of the teams. In the next section we examine role of coordination and control in determining team boundaries. The role of workers' knowledge and decision-making domain is explored in section 5.

4. Teaming as an Organizational Control Problem

Under Taylorism supervisors give directions, monitor performance, and assure the continuity of the production process by managing the interfaces between individual tasks. Middle managers have similar tasks of setting goals, monitoring performance, and coordinating activities of the departments that they manage. Workers perform and master narrowly-defined jobs which have a low degree of ambiguity.

This mechanism for coordination and control becomes inefficient if the individual tasks are highly dependent upon each other and are subject to uncertainties. Under these conditions the performance of each worker may depend on events he does not control. Even if a worker executes his task with great diligence the overall objective may not be met, and in some cases it may be detrimental to the overall goals, unless all the dependent tasks are also executed with equal efficiency. Thus for the supervisor the burden of coordination increases, and at the same time it will be difficult to assess the performance of individual workers. In general control becomes difficult under conditions of (1) high performance ambiguity, or (2) low goal congruence (Ouchi [1980]). In other words, managers and supervisors will become less efficient if: (1) they cannot accurately evaluate the performance of the departments or individuals that they manage, and (2) if their goals are in a sharp conflict with the goals of those they manage.

In order to mitigate the control problems, companies may decide to spend resources on increasing the goal congruence between various levels of the organization. Profit sharing schemes, such as the one we observed in plant B, can increase the alignment of the goals of the firm and its employees at all organizational levels. In addition, the adverse economic conditions faced by plant A may have resulted in high commonalty of goals, at least temporarily: the possibility of losing their jobs may have motivated the workers to internalize the survival of the company as a goal, rather than pursuing the narrowly defined goals of increasing wages and perhaps even gaming the system. Finally, goal congruence might also be increased by narrowing the distance between managers and workers, for example by eliminating some management perks.

In addition to increasing goal congruence, companies can also redesign their internal boundaries to reduce performance ambiguity and simplify the coordination problem. For this purpose internal boundaries will have to be drawn around highly interdependent parts of the production process and between independent parts of the production process . Tasks inside each boundary are assigned to one team. The

independence of performance between the teams may be reinforced by measuring several parameters of performance at this boundary such as quality, response time, delivery schedules, productivity, etc., and by using devices such as decoupling inventories between the team boundaries. Team members also assume some of the tasks of internal allocation of resources, performance monitoring, and coordination. Empowering teams in this manner reduces the dependence of the team on external agents and thereby reduces the performance ambiguity for the team as a whole, though individual performance ambiguity may increase. In general, the *external contingencies to which a team is subject are minimized* .

The overall efficiency of the reorganization, however, depends heavily on the ease with which team members can execute the tasks that were performed previously by supervisors and managers. The assumption is that team members working closely with each other can direct their efforts toward (now more clearly defined) targets and observe each others' performance more efficiently than a hierarchy of supervisors. Obviously, after a certain level of aggregation and in very large teams this internal direction of effort toward team goals, monitoring, and coordination become increasingly problematic. On the other hand, as more tasks are pooled and assigned to teams, the external goal setting, monitoring, and coordination involves dealing with a smaller number of agents (teams rather than individuals). The optimal design of teams is thus likely to balance these two conflicting trends.

Thus the introduction of teams means that external (and hierarchical) performance evaluation and coordination is restricted to some attributes of the joint output of the team. Team design entails selecting points in the production process where group performance can be relatively unambiguously measured and directed.

As an illustration of this analysis consider the reorganization carried out in plant A. The airframe structure consists of modules such as wings, doors, and pressure floors. The wing assembly in turn consists of a leading edge and a trailing edge. Before the introduction of teams, the assembly operation of the leading edge was partitioned into 8 tasks that were assigned to individual operators. After the reorganization, a team of 8 members is responsible for the entire leading edge assembly operation. The trailing edge is the responsibility of another team. An alternative approach would have been to combine the leading edge and the trailing edge into one team. If job enrichment, interpreted literally, was the sole criterion for aggregating tasks, then the firm should have combined the two teams.

The eight tasks in the assembly of the leading edge are highly interdependent. There are precedence constraints on the order in which the tasks can be executed. The contour of the wing is complex and specifications for intermediary steps leave some latitude to the assemblers. It is possible for a workers to compensate for some minor errors from other steps in the process. On the other hand the requirements for the boundary between the leading edge and the trailing edge are precisely defined by the customers. Consequently there is relatively very little dependence between the tasks in leading edge and the trailing edge sub-assemblies. The dependence arises largely from the fact that one of each sub-assemblies is required for a wing. Thus these two parts of the production process could be separated without making it difficult for management to set clear goals in terms of quality and delivery schedules, and to monitor performance.

From the perspective of the team members, two separate teams make it easier for workers to allocate resources and direct their efforts towards fulfilling team goals. Precedence constraints, the physical proximity that results from the smaller team size, and the similarity of skills within the team make it possible for workers to coordinate activities, redistribute efforts as the conditions on the floor require, and monitor each other.

As an additional illustration consider the team design adopted by plant B. The manufacturing operation is a long production line assembling three products. Two of the products have a common module. The operations were partitioned into seven teams as illustrated in Figure 2. Final assembly is carried out by five teams, and there are two sub-assembly teams. The primary concern in selecting team boundaries was to ensure a clear definition of the output (i.e. to reduce performance ambiguity). A second concern was to ensure that all members of the team served the same set of customers (i.e. to increase goal congruence within the team). These customers may be other teams or external buyers. In this plant, production interdependencies between shifts doing essentially the same set of tasks are very low: consequently, team boundaries are drawn between shifts. While inventories between work stations within a team are very low (one unit), inventories between teams are much higher.

The break-up of a long production line subject to uncertainties results in well-defined goals for the teams. The buffer inventories between teams decrease the dependencies between teams. In spite of this partitioning of the production activities, teams in plant B are very large. In some teams there are over one hundred members. Due to the large size of the teams and the presence of uncertainties in the line, mechanisms that facilitate internal control are needed. One of the devices that make it possible for these

large teams to successfully direct, monitor, and coordinate individual work efforts are low inventories within team boundaries. In addition team member periodically provide formal feedback about the performance of other team members.

Let us now turn to the benefits that arise from the introduction of teams. One of the savings that result from the introduction of teams is that the overall load of setting goals, monitoring performance, and coordinating activities by supervisors and managers is reduced. As a result, fewer people in the organization will be needed for these tasks. Due to reduced ambiguity, these tasks may be performed in an inherently more efficient manner. The elimination of a number of hierarchical levels in plant A, and the elimination of supervisors in plant B are consistent with this analysis.

We can also expects gains in productivity due to more efficient coordination and allocation of resources to internal tasks. The following is an interesting illustration of these types of gains.

In plant A, prior to the introduction of teams the time to assemble a section of the pressure floor consistently exceeded the standard time. The product had been produced in the plant for several years and it was believed that the learning curve effects were exhausted. After the teams were formed there has been a steady decrease in the number of hours required to assemble the product, and an improvement in the delivery performance. The standard hours, however, were not changed when the teams were introduced.

A large part of the improvement in delivery performance and gains in productivity in this case were attributed to better direction of efforts and improved coordination of tasks within team boundaries. Almost all the team members have been at this plant for more than ten years and are qualified to perform all the tasks. In the new setting, workers redistribute efforts and direct them to stages where delays are occurring. A smaller number of job categories and crosstrained workers enable the redistribution of work. In the old system the work pace was determined by the slowest worker on the line. Much of the monitoring effort of the supervisors used to be directed at the slower workers. Now some of the quicker workers assist the slower workers. In addition, information necessary to make decisions crosses much shorter horizontal paths and many problems are resolved at the source.

This example also raises some intriguing questions regarding the motivation of the

workers. All the workers in the team have reached their ceiling in terms of merit pay, and because there is no gain sharing, reductions in completion times do not provide any direct monetary benefits to the team members. One of the goals of each team is to reduce the number of hours required for assembly. The rate of improvement and the actual target for each period, however, is determined by the teams. The improvement in processing times have reduced the number of overtime hours. Hence improvements are causing a decline in the employees' wages. Yet the team is continuing to reduce the hours required for assembly. There are two possible explanations: (1) the workers believe that improved profitability is important for the long term survival of the plant and therefore their jobs, and (2) the new work environment is an intrinsically preferable way of organizing production from the workers' perspective, unleashing their ability to perform better. The second explanation is consistent with the assumption that workers do not (or seldom) consciously and opportunistically withhold output. New work methods enable the workers to better utilize their skills and knowledge. We will return to these issues in sections 5, 6 and 7.

5. Expansion of Workers' Decision-Making Domain

Clearly, the domain over which workers can effectively utilize their knowledge should be taken into account while designing teams. These considerations have influenced the team design at our field study sites. In company A, in the sheet metal assembly area workers posses considerable product specific expertise and the teams in this area are product based. In the composite area where the relevant knowledge is primarily process oriented, teams are process based.

An example from the composites area of plant A illustrates that in some cases, redrawing internal boundaries can expose previously invisible inefficiencies in the organization's incentive structure that can be reduced by expanding the decision making domain of the workers. A graphite beam was shipped to plant A from the plant of a subcontractor. The component was delivered to a warehouse that was a few miles from the actual assembly location. Before the component reached the work site it was stored in several intermediate locations, resulting in wasteful handling and expensive damage to a fragile part. After the reorganization, the team that was assigned to the product recognized this problem and proposed a detailed relocation plan for its work site. The cost of relocation was $40,000 but the annual savings due to reduction in handling and decrease in the number of damaged beams is estimated to be $750,000. Previously, operations planning and scheduling group was responsible for the warehouse. The group

was responsible for storage costs that included warehouse cost but not costs due to damages in handling. Thus, previously no one in the organization was directly responsible for the problems associated with this particular product; after the re-organization, the team took responsibility.

In addition, in plant A we encountered several examples of improvements in quality and productivity as a result of employee involvement in innovation and problem solving. Some of these examples are described below.

For one of the wing panels, an employee who built close to 900 of these components consistently complained that the locations of the rivet holes were incorrect and that the sheet profile had to be changed. This problem was costly because the employee had to take several measurements and manually adjust for misfits. In spite of the many studies conducted by the company's engineering staff this problem could not be solved. Engineers reached an incorrect conclusion that there was an error in the design. The company made several unsuccessful attempts to obtain engineering change order from the customer. When the product team was formed the team members jointly addressed this problem. A careful study conducted by the team revealed that the fixture that was being used to produce the part was inaccurate. Since this could be modified by the company without any authorization from the customer the change was made. Clearly, the knowledge and experience that the workers accumulated over time and the new setting that encouraged them to jointly address the problem made this particular solution possible.

We encountered several examples of technological innovation in the composites area. The team in the first stage of the process modified a curing machine so as to make it easier to measure the temperature. While the composite is being cured temperature measurements have to be taken to control the process. The result of this innovation is greater constancy in quality of the cured part. Another team solved a quality problem by developing an inexpensive device for applying sealants to fastener. The device was made by cutting out a piece of thermocole. Yet another team developed a machine for accurately cutting the graphite sheets. The prototype was developed by the team during their free time in the garage of one of the team members. The machine was further developed by the mechanical and manufacturing engineers. Finally a machine tool manufacturer was contracted to develop a numerically controlled machine based on the concepts developed by the team. Each of these innovations improved the quality of the final product.

Observe that each of these improvements arose primarily due to expanding the decision making scope of the workers. Considerations of monitoring and control are largely irrelevant. These ideas were not elicited from the work teams. As stated earlier, since there is no gain sharing the employees do not directly benefit from these innovations.

Underlying the discussion in the previous section is the assumption that if the individual is not fully committed to the larger organization, then incentives and monitoring are needed to elicit the proper effort. An alternative behavioral assumption is that workers possess pride in a job well done regardless of the formal accountability. The drive to excel arises purely from a commitment to the craft and is unaffected by the monitoring mechanisms but is constrained by the organizational boundaries. The above examples illustrate the process improvements that arise from allowing the workers to effectively apply their knowledge. In sum, team design is based on considerations of workers' knowledge and expertise, as well as the re-definition of the points of management control. The proper balance will depend on the particular conditions in an organization.

6. Union Responses to Team-based Work Systems

To this point, we have taken the firm's perspective on teaming: under what circumstances, and at what level of aggregation, will teaming produce quality improvements, productivity gains or cost savings? An obvious point of contention involves the distribution of these gains, behind which lies the question of who is responsible for the improvements. We now briefly analyze the responses of unions to team-based systems.

The previous industrial relations literature has tended to focus on the circumstances under which team-based work systems are successful in the unionized context; the most consistent finding seems to be that union involvement is a key factor (Cooke[1990], Verma[1989], Wever[1989]), though some have found that even in the absence of union participation, team-based work systems tend to increase worker identification with the company (Verma & McKersie[1987]). All of the aerospace sites that we visited were unionized, and thus far one of the two firms has been successful in implementing the team concept (though to a limited extent). The union has been involved in the reorganization effort right from the beginning at the aerospace firm where teams have been successfully implemented. At the outset the formal union contract was re-

negotiated to accommodate teams. Representatives of the union are members of the steering committee that oversees the change process. On the other hand, the other aerospace firm has not been successful in implementing teams. We will not attempt to explain this outcome here, but merely point out that the local chapter of the union was not closely involved in the implementation or operation of the team concept.

In this section we briefly describe the system of American job-control unionism, summarize the responses of the main aerospace unions to team-based work systems, and speculate about possible reasons for these responses.

The American system of job-control unionism was developed and frozen into place during the only period of significant pro-union legislation in US. history: the "New Deal" era of the mid-1930s. One way to think of this system which is particularly useful for our purposes is that the Tayloristic conception of a "job" (or a well-defined set of tasks) was taken as the organizing principle for defining the boundaries of managerial discretion and determining how much individual workers get paid. To give a simple stylization: in a typical US union contract, particular jobs are well-defined and finely divided, pay rates are attached to the particular jobs, and job allocation is by seniority. Note that pay is not directly determined by seniority; rather, a worker's job is determined by his or her seniority level, while the rate of pay is determined by the particular job. Thus, managerial discretion to re-allocate workers across jobs is severely limited, as is the ability to specify the nature of the jobs themselves and to differentially pay individual workers or small groups of workers (e.g. for productivity). Finally, much of the legalistic grievance procedure is also organized around the concept of a job: a worker in a particular job can only be asked to do certain well-defined tasks, and promotions to perform different tasks must follow a well-defined (generally seniority-based) procedure. Kochan, Katz and McKersie[1986] describe the system as follows:

> Job control unionism entails highly formalized contracts and a quasi-judicial grievance procedure to adjudicate disputes during the term of those contracts. In this system workers' rights and obligations are linked to highly articulated and sharply delineated jobs. For example, what a worker is expected to do on the job is outlined in a job description and a job ladder typically is included in a plant's local collective bargaining agreement. Strict lines of demarcation separate jobs within the bargaining unit from work performed by supervisors or work belonging to members of some other bargaining unit. Workers' income is determined by attaching a particular wage rate to each specific job. Unions control career income by seniority rules governing the allocation of internal job vacancies among candidates for promotion. Job security is

> maintained by a set of rules that specify who gets laid off (after management decides a layoff is to occur) and how the remaining work is allocated among the workforce.
>
> In this system of job-control unionism, industrial democracy is reduced to a particular form of industrial jurisprudence in which work and disciplinary standards are clearly defined and fairly administered and disputes over the application of rules and customs are impartially adjudicated through the grievance procedure. Administration of the labor contract, with its detailed written rules, becomes the central task for management and union leaders during the term of the agreement The workings of this system require that jobs are unambiguously defined and changes in job definitions and work assignments are sharply delineated. (pp. 28-29).

The responses of the unions to team-based systems (and the deviation from the job-control model they entail) has not been uniform[4]; here we will summarize the responses of the two major unions in the aerospace industry, the United Automobile and Aerospace Workers (UAW) and the International Association of Machinists and Aerospace Workers (IAM). The governing faction of the UAW has endorsed team-based systems in particular situations, the most famous example being NUMMI (Adler[1992]). The main minority faction of the UAW has opposed aspects of team-based systems as "management by stress" (Parker and Slaughter [1988]). And, the IAM, the other main union in the aerospace industry, has opposed these systems in principle, stating that "By their very nature, these (TQM/LMC/QWL/QCC/EI) programs interfere with the union's obligations (1) to represent each and every member of the bargaining unit, (2) to enter into collective bargaining over wages, hours and working conditions, (3) to abide by and enforce the terms and conditions of any collective bargaining agreement already in effect, and (4) to preserve the integrity of the union as an autonomous, democratic organization

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4 For a detailed discussion of organized labor's reaction to industrial reorganization in the world automobile industry, see Katz and Sabel[1985]. See also U.S. Department of Labor[1984] for a collection of union positions on labor-management cooperation. Eaton[1990] provides a discussion of the labor movement's approaches to participative programs in general. She notes that "Few internationals have articulated an explicit policy toward these programs, and those that have done so run the whole gamut of perspectives" (p. 605). She goes on to note that most unions, whatever their general orientation toward participative programs, recommend protective actions by their locals if they are involved in a program, ranging from seeking direct control over the outcomes of the programs (e.g. layoffs, speedups, sharing of financial gains from participative programs and compensation for time spent in them) to seeking indirect influence over the process (e.g. participation in the planning and design of the program, prohibition of discussion of contractual issues within group meetings).

free from employer domination according to the laws of the land" (IAM[1990]).

Why, then, might unions oppose these systems? The most obvious answer is that team-based systems destroy the whole basis for job-control unionism: in the words of Kochan, Katz and McKersie[1986], when jobs are no longer unambiguously defined "it is impossible to attach specific wages and employment rights to each job, and the governing rules and customs become too ambiguous to be administered effectively through the grievance procedure" (p. 29). Further, if the job-control model limited supervisor discretion by clearly defining jobs and the conditions for their allocation, this protection disappears with the elimination of the concept of a well-defined job. At the very least, teaming implies a radical re-organization of the principle of a job, usually taking the form of severely limited job classifications; with this re-organization comes a loss of the basis for many of the traditional protections afforded by unions through the grievance procedure.

A closely related issue involves the relationship between management and the representative of the workers as a collectivity, the union. In its essence, the shift from the job-control model to a team-based model involves a substitution of trust for rules as the basis of this relationship. Under the old system, the rights of the parties were very well delineated in the union contract with the well-defined jobs; under the new system, the union must trust the company to not take advantage of its new discretion in the absence of the old rules. Where trust is low, as at one of our aerospace sites, the system does not work. Where management is willing to foster the trust of the union and the workers by forgoing its traditional prerogatives, as at NUMMI where the management cut its salaries relative to the rest of the industry and gave up other symbols of authority such as separate dining facilities, the system may be more likely to work. At plant A where the system does seem to work, the union representatives placed emphasis on the open communication that exists between the union and the management, and the significant reduction in overhead costs that came about due to attrition in the salaried categories.

Unions are also very concerned that the workers' knowledge of the work process may be unfairly expropriated under teaming. The basic notion is that an industrial engineer would be generously compensated for discovering a method to significantly improve the work process; why shouldn't a worker who volunteers such a suggestion be equally compensated? (Recall the examples of worker-inspired cost savings noted above). One way to conceptualize the role of the union is that it tries to protect the workers from having this valuable knowledge taken without proper compensation by management.

The consequences of quality improvements that may come from teaming also raises a significant issue for the unions. In particular, is management trying to trick workers into planning themselves out of their jobs? Under the job-control model, employers have total control over how many people (if not which particular people) to employ at any given time, but the assumption implicit in this model is that any such employment fluctuations are mainly driven by factors beyond the control of the workers (and often even the particular employer, such as fluctuations in the output market). Unless the division of the gains from worker-inspired improvements (and in particular the nature of employment adjustment) are clearly specified ex-ante, unions tend to be suspicious of teaming as attempts to use workers to eliminate their own jobs; note that shifts to team-based systems in the unionized context are often accompanied by employment guarantees (Katz and Sabel[1985]). The contracts negotiated by the unions and the aerospace firms in our study do not contain employment guarantees, however.

Another common source of union opposition is that, in contrast to the sites described in this paper, team-based work systems often go hand-in-hand with continuous improvement systems such as at NUMMI. The union objection to continuous improvement is that it amounts to management by stress, where management extracts more effort from the workers than they are fairly compensated for. Does teaming mean "working harder" in addition to "working smarter"? To put it another way, do teams involve more productivity for the same level of effort, or are workers forced to work harder? This line of argument also has a long lineage in the social sciences; a relatively recent formulation comes from Marglin[1974] who lays out the arguments for the historical development of the factory: did the factory form of organization in its essence lead to more output for the same level of (effort) input due to efficiencies in the organization of work, or, alternatively, was the movement from the putting-out system to the factory driven by the desire of the nascent capitalist to get more effort from the workers than they would contribute on their own given the choice? This question speaks to the difficulty in separating pure team-based work systems from the continuous improvement system characteristic of NUMMI.

Finally, unions tend to be suspicious of teams as attempts by management to engage in "union substitution": they are concerned that workers will perceive the teams as meeting some of the collective needs traditionally defended by the union (for example, by addressing certain working conditions which are legally mandatory subjects of bargaining

in the U.S.).[5] Verma and McKersie[1987] found that teams introduced in a unionized setting without union involvement increase worker identification with the company[6]; a union fear is that employee involvement programs "work openly to include the employer as part of the worker's definition of 'we'" when "solidarity in the labor movement hinges on the concept of 'we'" (Parker[1985: 34]). Beyond the fear for the survival of the union as an institution, the concern extends to the welfare of the workers: how can an organization formed and promoted by the company ultimately adequately represent the workers' interests when these interests come into conflict with those of the company? The unions' fear, simply put, is that the companies are attempting to re-cast an inherently adversarial process as something that can be "cooperative" without specifying the exact terms of the new system, to the ultimate detriment of the workers' interests.

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5 The Commission on the Future of Labor-Management Relations, chaired by John Dunlop, has been holding high-profile hearings on the legal obstacles to team-based systems under the National Labor Relations Act.

6 Verma[1986] notes that "unions fear that workers who join EI programs may lose interest in unionism and, in the extreme, may even oppose their unions to support the management on a variety of issues" (p. 306), but concludes from his analysis that "there is little basis for unions' general and a priori apprehension about EI programs" (p. 311).

7. Worker Responses to Team-based Work Systems

This section briefly sketches some models of human behavior that might provide partial explanations for worker responses to the introduction of team-based systems that appear to violate the assumptions of the rational/opportunistic paradigm.[7] Extreme examples of these types of responses are the cases where workers work themselves out of paying hours, improving quality to the point where they greatly reduce their overtime, or even work themselves out of a job, as we observed at one of the aerospace sites where workers were laid off once they had sped the completion of a particular project.[8]

Some worker responses to team-based systems might be motivated by the extent to which groups of workers share a sense of solidarity. It is possible that workers are more willing to share their knowledge of the production process with each other than with the supervisor; that who is viewed as expropriating the knowledge can be as important as what gets expropriated. Workers may be more willing to work together in a group of workers than to engage in "gift exchange" (Akerlof[1984]) with the boss, and they may respond more openly and positively to suggestions that come from fellow workers than from perceived authority figures. We saw what may be a particularly striking example of this sort of enthusiasm at one of the aerospace sites where team members developed a prototype machine in their "garage" during off-hours. While overlapping with the intrinsic motivation approach, these issues certainly overlap as well with the concern of unions that teams in some sense substitute for the main function of unions: providing a forum for the expression of the collective interests of workers.

Other worker responses to team-based systems might be driven by the model of the world held by blue-collar workers. Specifically, to the extent that workers maintain a "customary" model of the world of work, where change is incremental and past practice is a strong determinant of perceived order and justice, a switch to a team-based system could be very unsettling and provoke a strong negative reaction (see Piore[1972] and Sabel[1982] for discussions of customary behavior among blue collar workers). What if notions of industrial justice come to center around the traditional grievance and job-allocation systems? Closely related is the issue of the importance of fairness to the

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7 For a more systematic examination of worker survey responses to worker participation, see Kochan, Katz and Mower[1984].

8 We note, but will not further explore, the importance of intrinsic motivation as a possible explanatory factor; we refer the reader to the long literature on "commitment" mentioned above.

workers' world views. Under the job-control unionism model, the nature of the bargain was clear: workers had to perform a particular job with well-specified duties, for which they would be paid a wage negotiated by the union, and the authority structure was unambiguous. Under the team model, the nature of the bargain and the lines of the authority structure may become blurred, thus violating notions of fairness arising from the traditional job-control system.

A further complicating factor is the issue of workers' alternatives: teaming has been introduced heavily in manufacturing, and with the de-industrialization of America, fewer and fewer desirable alternative opportunities are available for many of these workers. At the aerospace firm in this study that has successfully implemented teams with the involvement of the union, the union contract states that "On behalf of all employees, the [union and the company] commit to employee involvement. We believe that a joint partnership provides the strongest competitive edge in our business environment." Implicit in this statement is the acceptance by the parties that team-based systems are necessary for survival in the newly competitive environment; it does NOT necessarily imply that the union or the workers views the new systems as preferable to the old in the absence of these changes in the external (to the workplace) competitive environment. If the team-based system is viewed as less desirable than the old job-control system by an aerospace worker (for whatever reason), but the only alternative is to work in the lower-paying service sector, then the team-based system might be accepted out of desperation, or at least out of a resigned acceptance that it beats the available alternatives..

8. Conclusion and Summary

In this paper, based on our field observations, we explored how the introduction of teams affects the firm, the workers and the unions. We view the new method of organizing work as a sharp departure from Taylorism, and discuss two possible sources of gains from this change.

Many of the gains that we observed can be attributed to the involvement of workers in coordination and problem solving domains from which they were previously excluded. Gains also accrue from re-defining the points of managerial control and aligning incentives within teams.

Although no formal surveys were conducted, our conversations with union representatives and first level managers suggest that while the workers may not be very

enthusiastic about the reorganizations, they nevertheless tend to accept the new work arrangements. Note, however, that we have not identified the source of this acceptance; it could range from improved intrinsic satisfaction with the work to a recognition of the loss of desirable alternatives due to recent industrial restructuring.

The plants that we visited were in the manufacturing sector, and over the period in which teams have been introduced, employment levels have declined or stayed flat. It will be interesting to observe how rapid growth will impact the commitment of top management to teams, when and if rapid growth does occur.

The introduction of teams is having a significant effect on unionized industrial relations. As labor relations in most unionized manufacturing workplaces in this country have been based on the job-control model, the system of industrial relations is evolving rapidly as these changes in the organization of work continue.

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