DOCUMENT RESUME

ED 339 835 CE 059 743

AUTHOR Brown, Clair; And Others
TITLE Skills and Security in Evolving Employment Systems: Observations from Case Studies.
INSTITUTION National Center for Research in Vocational Education, Berkeley, CA.
SPONS AGENCY Office of Vocational and Adult Education (ED), Washington, DC.
PUB DATE Nov 91
CONTRACT V051A80004-90A
NOTE 41p.
AVAILABLE FROM National Center for Research in Vocational Education Materials Distribution Service, Horrabin Hall 46, Western Illinois University, Macomb, IL 61455 (order no. MDS-131: $4.00).
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Adults; Case Studies; Dislocated Workers; Employer Employee Relationship; *Employment Practices; Inplant Programs; Job Layoff; *Job Training; Labor Force Development; *Participative Decision Making; Personnel Management; *Personnel Policy; Unemployment; Work Environment
IDENTIFIERS Employee Participation; *Employment Security; *Security Employee Involvement and Training System

ABSTRACT

An emerging U.S. employment system is the Security, Employee Involvement, and Training (SET) system. The system is characterized by the following: (1) a high degree of employment security based upon flexible job assignment; (2) employee involvement in problem solving and continuous improvement; and (3) continuous training of all employees. Case studies of five firms that are attempting to establish or maintain SET indicate variation in the degree of successful transition to a SET system. A working SET system is in place at Together Manufacturing and Valley Life; Traditional Manufacturing has been unable to put together all the elements of SET; Hi-Tech's plants range from successful SET factories to traditional ones; and CommEx has been in retreat from SET. The study discovered the following: (1) the maintenance of strong employment security practices at Together and Hi-Tech; (2) repeated decreases in the work force and weakening of employment security provisions at CommEx; and (3) a one-time downsizing at Valley Life. Together's commitment to employment security has been successfully tested by a period of reduced product demand; Hi-Tech's has not. Hi-Tech has instituted a new basic skills test as a minimum standard for employees. Together and Valley Life have made learning a part of daily work. Companies that have successfully instituted SET systems have put all three parts of the SET triangle in place. Research suggests implications pertaining to initial education, further education and training, and restructuring of the work process within schools. (50 references) (YLB)

SKILLS AND SECURITY IN EVOLVING EMPLOYMENT SYSTEMS: OBSERVATIONS FROM CASE STUDIES

Clair Brown
Michael Reich
David Stern

University of California at Berkeley

National Center for Research in Vocational Education
University of California at Berkeley
1995 University Avenue, Suite 375
Berkeley, CA 94704

Supported by
The Office of Vocational and Adult Education,
U.S. Department of Education

November, 1991

MDS-131

FUNDING INFORMATION

Project Title:	National Center for Research in Vocational Education
Grant Number:	V051A80004-90A
Act under which Funds Administered:	Carl D. Perkins Vocational Education Act P.L. 98-524
Source of Grant:	Office of Vocational and Adult Education U.S. Department of Education Washington, DC 20202
Grantee:	The Regents of the University of California National Center for Research in Vocational Education 1995 University Avenue, Suite 375 Berkeley, CA 94704
Director:	Charles S. Benson
Percent of Total Grant Financed by Federal Money:	100%
Dollar Amount of Federal Funds for Grant:	$5,675,000

TABLE OF CONTENTS

THEORETICAL AND METHODOLOGICAL FRAMEWORK

Recent research (Kochan, Katz, & McKersie, 1986; Osterman, 1988) on employment practices in the United States has described an emerging employment system characterized by (1) a high degree of employment security based upon flexible job assignment, (2) employee involvement in problem solving and continuous improvement, and (3) continuous training of all employees. We will denote this model as the Security, Employee involvement, and Training (SET) system. The SET system typically includes teams of employees who are cross-trained and rotate jobs, who engage in ongoing problem solving, who make and implement suggestions for long-term improvements, and who inspect their own work. The compensation system may include motivational rewards for company performance (profit-sharing), team performance, and skill acquisition (pay-for-skill). In unionized settings, the union and company have a cooperative relationship, and grievances are settled informally at the first level whenever possible. Until recently, the SET system could be found at a small number of large companies and often only among salaried employees (Foulkes, 1989). Now it is said to be spreading to more firms and to more hourly employees as well (e.g., see Dumaine, 1990).

The SET system contrasts with the employment system that has prevailed in unionized firms during the past fifty years where security is determined by seniority within a narrowly defined job classification, employee involvement is impeded by a traditional adversarial relationship between the union and management, and firms make only a minimal investment in training hourly employees. In this paper, we refer to this set of practices as the JAM system—for Job classifications, Adversarial relations, and Minimal training.

In JAM, workers have well-defined specialized tasks, and they move up a ladder of job titles differentiated by small increments in pay and other desirable characteristics. Pay is based on seniority, since seniority determines job assignment (with skill the deciding factor only if there is a "head and shoulders" difference). The union bargains production standards (i.e., work speed) and work rules for job assignment. "Quasi-security" for more senior workers exists since layoffs are based on seniority. The union and company have an adversarial relationship in which the union uses the grievance system, work rules, and work stoppage as its basis of power, while the company uses worker discipline, automation with declining employment, or plant closure as its basis of power.

In non-union U.S. firms, although there is wide variation, practices for hourly employees are generally more similar to JAM than to SET. Some non-union firms provide a limited promise of employment security to their experienced hourly employees, while maintaining authoritarian direction of employees and minimal training. We refer to this combination of practices as the SAM system (see Foulkes, 1980, for a discussion of SAM systems). Other types of non-union systems are also prominent in the United States, including those whose employers pay low wages and are hostile to improving employees' working conditions and pay. These systems are not the focus of our concern in this paper, however.

The three elements of SET are also central to what has been described as the prevailing system in large Japanese firms (see Aoki, 1988; Koike, 1988). Training, use of teams, continuous skill upgrading, and high levels of employment commitment are not, of course, universal in Japan. Nor are they uniquely Japanese features, as they also form elements of successful European experiences as well (e.g., see Soskice, 1989; Streeck, 1989). As Turner (1990) and others have emphasized, more centralized labor-management relations also form an important part of the European story. American firms, both with and without unions, are being urged to move toward SET on the grounds that SET will make U.S. producers more competitive in world markets (Dertouzos, Lester, & Solow, 1989), maintain high wages and living standards (Cohen & Zysman, 1987; Commission on the Skills of the American Workforce, 1990), and provide more satisfying working conditions as well as a more equitable distribution of employment and income (Osterman, 1988).

How do SET systems work in practice? Assuming the SET system is so attractive, why is it not yet more widespread? What factors enter into the benefits and costs of firms moving toward SET? This paper addresses these issues through case studies of five U.S. firms that are attempting to establish or maintain SET. We discuss the new demands on hourly employees, the problem of employment security, and, in three firms, the role of unions. In conclusion, we compare the experiences of these firms and offer an assessment of the prospects for wider adoption of the SET system in the U.S. economy.

Our main impression is that the transition to SET involves a significant investment and change in production and employment practices, which not all companies are able to

achieve. The three elements of SET reinforce each other. Much like the three legs of a tripod, each must be in place for companies or plants to be successful in adopting SET.

Figure 1 suggests how the three elements of SET reinforce each other, in theory. Employment security enhances employee involvement because employees are more willing to contribute to improvements in the work process when they need not fear losing their own or their coworkers' jobs. Employment security contributes to training as both employer and employee have greater incentives to invest in training. At the same time, training reinforces employment security because more highly skilled workers will be more productive and adaptable to new conditions, and training strengthens employee involvement because better trained workers have more ideas to offer. Employee involvement contributes to increased training by making the need for situated learning more evident and by increasing employees' interest in training. Finally, employee involvement also enhances employment security as higher productivity and quality make the company more competitive.

The absence of any one element of the SET system weakens the others. This interdependence explains why the many companies that have tried to institute only individual elements of SET have had mixed experiences (Kochan et al., 1986). Apparently, the transition to SET cannot be done in small incremental steps, as it involves a willingness to invest considerable resources in a substantial reorganizing of both production and employment systems.

Case Studies and Economic Theories of Employment Relations

Twentieth century labor economics in the United States enjoy a rich historical tradition of drawing upon case studies and field work by researchers. Early influential examples include, but are not limited to, Commons et al. (1918, 1935), Commons (1934), Slichter (1941), Dunlop (1958), and Kerr et al. (1960). Field work helps researchers to develop new conceptual frameworks, to note anomalies, to obtain new "stylized facts," to become aware of changes in continually evolving institutions, and to design and appraise innovations in public policies. Reports of field studies have at times even influenced economic theorists. One example is Kenneth Arrow's contributions in the early 1970s to the economic theory of discrimination. Arrow (1972) was heavily influenced by Doeringer

and others' case studies of dual labor markets in Boston. On-site observation, interviews, and surveys can be especially valuable in a time of rapid institutional change such as the present period. Examples of more recent field-informed research include Doeringer and Piore (1971), Piore and Sabel (1984), Katz (1985), Kochan et al. (1986), and Osterman (1988).

Although much of the earlier field-based observation and associated theorizing addressed unionized workplaces and collective bargaining issues, the general view of the employment relation that researchers developed encompassed a broader terrain. In non-union as well as union settings, a variety of internal employment systems were observed, often co-existing in the same external labor market and with the same set of technological choices available (Doeringer & Piore, 1971; Osterman, 1988). It appeared that phenomena such as choice of technology, skill demands and wage differentials by skill, history of employer and employee relations and the extent of training by the firm were inter-related. One feature could not be understood without examining simultaneously other features of the internal labor market. Moreover, these institutions were continually in flux and, at key points, underwent dramatic historical transformations (Gordon, Edwards, & Reich, 1982; Jacoby, 1985).

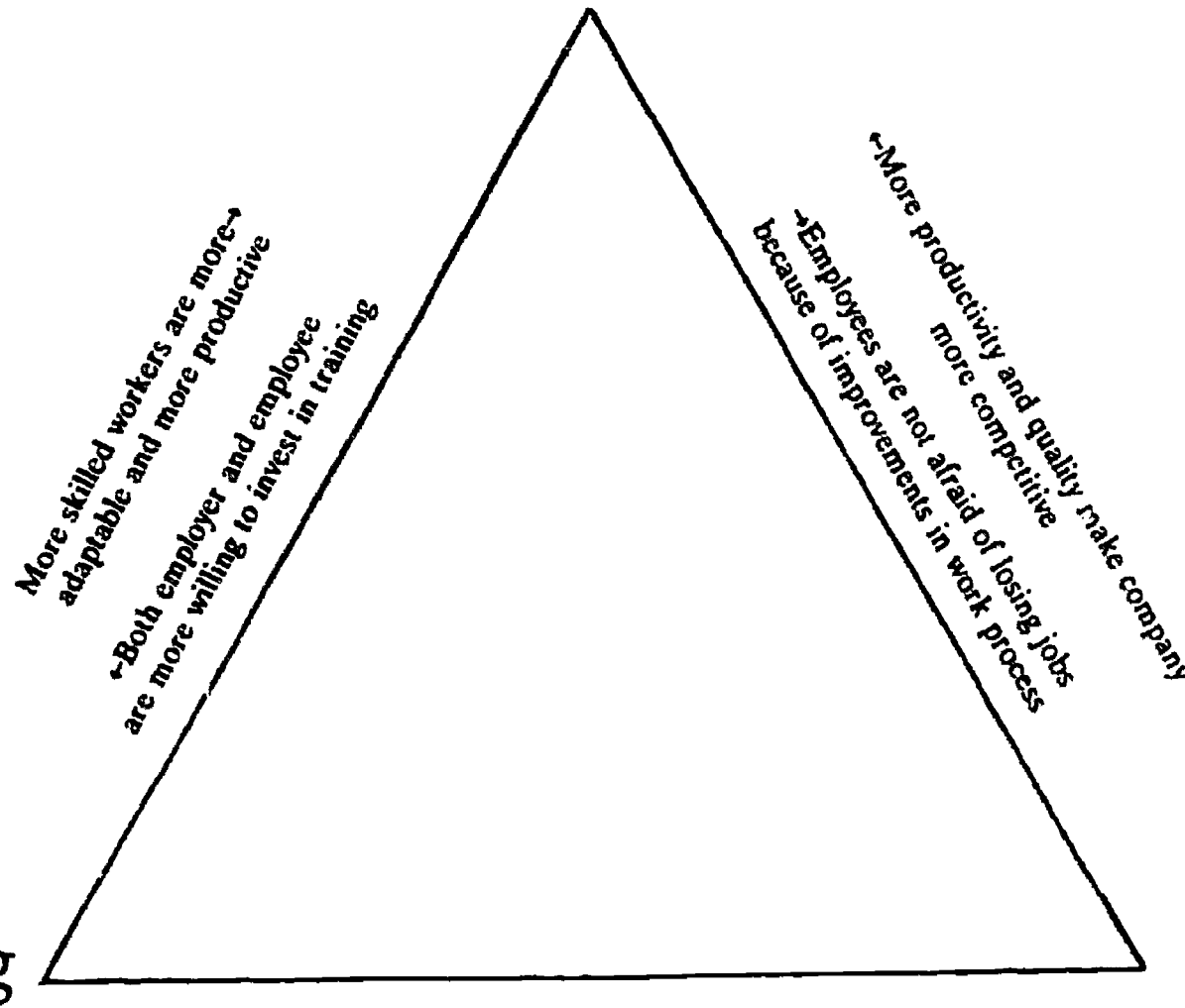
While case study-based labor market research has continued, in the past twenty-five years many applied labor economists have tended away from field work and institutional analysis and toward microeconomic theorizing and econometric analysis using newly available large-scale national micro data sets. Many of these researchers were less interested in institutional or historical forces in labor markets than earlier generations of labor economists, for whom the evolution of collective bargaining institutions had been formative. A greater concern was exhibited for showing how the application of a few core ideas from microeconomic theory could account for much of what previously had been labeled as idiosyncracies of labor market behavior. Recent surveys of literature that exemplify this approach include Borjas (1988), Lazear (1990), and Wachter and Wright (1990).

The traditional neoclassical economics literature on the internal organization of the firm in general, and on workers' skills in particular (which was initiated by the human capital approach of Schultz [1963], Becker [1964], and Mincer [1974]), has long reflected such a focus. This perspective has suggested that competitive firms efficiently

Figure 1

SET Theory

Security



→ Workers have more to offer

←Demand for situated learning becomes more evident and increases workers' interest in training

structure their internal employment systems and allocate resources to company-specific and general skill formation. The theoretical and econometric bases for such claims have been mixed. For example, employees in long-term employment relations possess bargaining power that Becker overlooks. The costs of and returns to training are difficult to measure precisely; studies typically focus on direct costs and assume wage increases measure productivity increases (see the review by Stern, forthcoming).

Some economists have begun to revise the traditional view by opening the black box of the firm, as in Okun's (1981) invisible handshake and Akerlof's (1982) gift exchange models. The econometric investigations of inter-industry wage differentials and efficiency-wage and rent-sharing theories have also contributed to an expanded view of the employment relation. (For a recent review, see Jacoby, 1990.)

Recent public debates concerning the alleged skill inadequacies of the U.S. workforce and the employment practices of U.S. firms have challenged the traditional perspective. Stimulated by the relative economic decline of the United States, and the success of the Japanese economy, a new interest in research on alternative employment systems has emerged. Many observers have suggested that the role of organizational structures and practices in facilitating workplace learning and training and determining productivity must be better understood, and that an alternative organizational form, often conceptualized (and probably idealized) as the Japanese model, is superior to the traditional U.S. model.

Field work and on-site surveys of skill and security trends offer advantages over conventional econometric analyses of these topics, which are constrained by the limited information available in large-scale data sets. It is significant that field work by Japanese economists (Aoki, 1988; Koike, 1988) as well as by Western sociologists (Dore, 1973; Cole, 1989), rather than large-scale econometric analyses, have best illuminated the differences between the Japanese and U.S. systems and indicated some weaknesses in the conventional economic analysis of skill. When one knows only a person's occupation, education, job tenure, earnings, and demographic characteristics, it is difficult to determine how his or her capacities are being used in the production process. The equipment being used and the production process involved are invisible, so the analyst does not know to what extent the person's skill and effort *can* affect productivity. In contrast, field work allows the researcher to observe the use of skills directly, including skills in problem

solving or in handling flexible tasks. When employers are transforming their practices, field work is necessary to observe changes.

Changing patterns in security systems are also not easily observable from large-scale data sets. While we can measure national job tenure distributions and their status over time, the interpretation of these aggregate observations is made difficult by their close relation to macroeconomic conditions and demographic characteristics. Field work permits the direct study of security systems and their impact on the production process. Qualitative case study research can be and is now frequently combined with collection of quantitative worksite-based survey data (e.g., see Lincoln & Kalleberg, 1990).

Our case studies provide much descriptive material. We use the SET theory outlined previously as an analytical framework to organize the descriptions of these cases and to provide meaning for comparisons among them.

The Current Study

To protect confidentiality, we use pseudonyms for our five firms. Hi-Tech, Inc., one of the large companies in our study, is a Fortune 100 manufacturing company. Hi-Tech has received favorable publicity for its success in developing new products to compete in foreign and domestic markets and for its investment in training hourly employees. Its stock did very well during the 1980s. Hi-Tech is a non-union company. At the time of our study, Hi-Tech was introducing SET systems into both its newer and older factories. We studied both the company-wide policies and the variation in experiences at three different plants.

Another manufacturer in our sample, Together Manufacturing, is unionized. The company was formed as a joint venture of an American and a Japanese company. It makes consumer durables and employs approximately twenty-five hundred people. It has been widely recognized for its effective use of the SET system, achieving outstanding results in labor productivity and product quality.

The third company, Traditional Manufacturing, is one of the largest consumer durable manufacturers in the United States. It has struggled, with mixed success, to

transform its operating plants from JAM to SET. Our case study focused on a specific plant that was experiencing problems in making this transformation. This plant employs about two thousand hourly workers and is unionized.

The two other companies in our sample are both in the service sector. The larger, CommEx, is in telecommunications. It employs approximately sixty thousand people, and most hourly employees belong to one of three different unions. CommEx has been regarded as a successful model of cooperative labor relations. It has also been financially successful, with its stock performing well in the 1980s.

The fifth company, Valley Life, is a small mutual insurance company, employing approximately two hundred and fifty people. It has attracted national publicity, including an award from the U.S. Senate for productivity improvement in 1987 for restructuring its Customer Services unit along the lines of SET. It has maintained the highest evaluation from A.M. Best Company, which rates insurance companies for financial soundness and overall management. Valley Life is a non-union company.

Each of these companies has made deliberate efforts to institute SET, and four have been financially successful. All five firms pay relatively high wages for hourly employees, ranging from approximately $10 per hour at Valley Life to nearly $16 at Traditional Manufacturing and Together Manufacturing, compared to a national average of $9.59 for nonfarm production workers in 1989 (U.S. Department of Labor, 1990). Regarding these as a sample of best-practice companies, we approached them with the intention of learning how they were trying to make SET work.

To gather data for this study, we visited these companies frequently, conducting numerous interviews with various levels of management, with union officials, and with production workers. We have observed the work process for short periods of time at many different production sites in these companies. We have sat in on training sessions and have conducted questionnaire surveys of employees in three companies. We have also collected qualitative and quantitative information from published reports and from the companies themselves.

Our presentation of the case study evidence is organized as a cross-company comparison of employee involvement and training issues and employment security

arrangements. As a guide to the comparative discussion, Exhibit 1 summarizes the status of each of the elements of SET at each of our companies. The reader can refer to this summary during the following discussion.

THE TRANSFORMATION OF HOURLY EMPLOYEES' ROLES AND SKILLS

Standardized Work and Job Rotation at Together Manufacturing

At Together Manufacturing, all employees work in teams, each of which practices job rotation, quality control, continuous improvement, and systematic problem solving. One new cognitive task assigned to team members at Together Manufacturing involves standardizing their own jobs. In traditional large-scale manufacturing, this kind of analysis is done by engineers. At this company, therefore, I.E. (industrial engineering) has been replaced by E.I. (employee involvement).

A job consists of a set of discrete tasks. In a sequential assembly-line operation, it is essential that each worker's job take the same amount of time. The process of assigning tasks to jobs to achieve this equalization is called job balancing. The amount of time for each job equals the duration of a shift divided by the number of units to be produced during that shift. At Together Manufacturing, the work time during each shift is twenty-seven thousand seconds, and the production target is normally four hundred and fifty units per shift, so each job should take about sixty seconds. Actually, each job is designed to take slightly less than sixty seconds, to allow some leeway.

As an aid to analyzing a job, the team uses a standard form. The sequence of discrete operations is written on the form, along with the estimated number of seconds for "hand work." "Walk time" is included between operations, where necessary. Hand work plus walk time add up to the total amount of time the worker should spend on that job. If any machines are used in the process, machine time is also shown on the form. This time is not included in the person's job time, since machines can be operating without a person's constant attention. For example, the "nutrunner job" is expected to take forty-seven

Exhibit 1

	Employee Involvement			
	Security	**Employees**	**Unions**	**Training**
Together Manufacturing	Yes, and maintained during periods of low product demand	Teams, job rotation, suggestions, design own jobs, problem solving, continuous improvement	Cooperative union-management relationship	Cross-training (OJT) by team leaders. Forty hours of formal training, including problem-solving skills, annually
Traditional Manufacturing	No. Layoffs common; some income security	Minimal	Cooperative union-management relationship	Minimal. One-time, forty hour program for EI
Hi-Tech				
Company-wide	For senior workers only		None	Problem solving; literacy testing and training
Old Plant	Some layoffs among junior workforce with declines in demand	Incipient: attempting to implement EI		Formal training for new roles
New Plant	Strong demand has not required layoffs	Teams, job rotation, suggestions, problem solving		Skill-based pay; cross-training; one-time training for EI
CommEx	Yes, but more conditions placed upon employees (job demotions and relocations) due to down-sizing	No. Incipient quality program outside union-management relationship	Cooperative union-management structure abandoned	Formal and informal training, as needed
Valley Life	Yes, but one-time down-sizing	Teams, multitask jobs, problem solving, continuous improvement	None	Pay for learning; cross-training by team members

seconds of hand work and ten seconds of walking time, for a total of fifty-seven seconds of a person's time. It also involves thirty seconds of machine time.

Team members not only standardize their existing jobs, they also are involved in redesigning and balancing jobs across teams and within teams when a model change or new product is introduced. Having team members standardize their own jobs makes the outcome more equitable and legitimate, since team members know better than engineers how much time and effort each task really takes.

The imbalances in jobs that inevitably remain are partially remedied by the practice of job rotation within the team. Imbalances across teams remain, however, and workers can apply for transfers on the basis of seniority. The company encourages teams to rotate jobs, but it allows the teams to decide exactly which members will rotate among which jobs, and how often. Job rotation does not usually mean that every member does each job every day.

Job rotation requires team members to learn each of the several jobs the team performs. Managing the learning process is one of the main responsibilities of the team leader. A "versatility chart" posted at the team's work area shows each team member's degree of proficiency in each job. There are four levels of proficiency: (1) knowing what the job is, (2) being able to do it under supervision, (3) being able to do it without supervision, and (4) being able to teach it to someone else. The team leader decides when a member has advanced from one level to the next. If a team member is absent, the versatility chart tells the team leader who else is best qualified to do the missing member's job(s). If the team leader is absent, the chart would make this information available to the group leader (first level manager).

The importance of job rotation from the team members' point of view was illustrated when a new product was introduced and jobs had to be restandardized. In order to minimize the number of defective units, the company directed the teams to stop rotating jobs until each person became fully proficient in one job. According to the union shop committee chair, workers were "outraged."

Continuous Improvement of Production Methods at Together Manufacturing

The management at Together Manufacturing emphasizes the importance of team members' suggestions for continually improving quality and reducing cost. In 1988, more than seventy percent of team members participated in the company's formal suggestion program, contributing approximately six suggestions per employee. This is high by U.S. standards, though some companies in Japan reportedly get as many as one hundred suggestions per employee per year.

Together Manufacturing pays employees for suggestions that reduce cost, improve product quality, or enhance workplace safety. Payment is proportional to the amount of net savings in labor time or cost of materials, with more points added for improving quality or safety. Employees are rewarded after the suggestion has been evaluated and implemented.

The cost savings to the company are illustrated by two typical examples of team members' suggestions. In one instance, a conveyor chain broke down four times during a nine-month period, resulting in costly downtime and destruction of materials. Rather than buy a new chain, the suggestion was to purchase additional trolley wheels and standardize the distance between the wheels, which previously had been inconsistent, resulting in undue stress on the chain. The resulting net saving, after deducting the cost of implementing the suggestion, was measured as approximately $100,000 per year.

A second suggestion involved a better method for removing sludge deposits from overspray basins in a paint shop. Instead of shutting down operations and contracting with outside companies to clean out the sludge, non-salaried employees suggested using a submersible pump attached to a small portable frame that can be placed manually into the sludge basins. This suggestion saved an estimated $17,000 per year.

In addition to including safety as one criterion for awarding payment in its suggestion program, Together Manufacturing involves workers directly in monitoring and improving workplace safety and health. A Zero Accident Campaign in 1988 included sending specially trained task forces around the plant looking for possible hazards, creating safety checklists, recognizing production teams with the best or most improved safety

records and sponsoring half-hour group meetings once a month on company time to discuss health and safety.

An example of a suggestion produced by the Zero Accident Campaign came from team members at a point on the line where one worker had to bend down to apply sealer, and another then had to bend down to smooth it. This continual bending produced cumulative back stress that can eventually cause injury. The suggestion was to excavate a shallow pit, two feet deep and twenty feet long, where workers could stand up straight and do the work at waist level. Management accepted the suggestion and had the pit installed during Christmas break, at a cost of $10,000. The company also made other costly improvements designed to avoid cumulative stress trauma, which is common in heavy manufacturing, thereby demonstrating a real concern for employees. In the case of the sealer pit, the company also received an unanticipated benefit because doing the work at waist level was so much faster that the same person could both apply the sealer and smooth it; thus two jobs were combined into one.

The problem-solving role of non-salaried team members at Together Manufacturing now extends beyond the walls of the plant itself. For instance, team members have been sent to work with materials suppliers who have trouble meeting Together Manufacturing's quality standards.

Moving to the SET System at Hi-Tech, Inc.

The case of Hi-Tech, Inc., provides an example of a non-union company that is trying to institute SET. Although the changeover is generally being accomplished at Hi-Tech in conjunction with the introduction of new technology, we observed instances where the SET system was implemented without changing the technology. Hi-Tech employees have been told that eventually everyone, even those who do not change jobs, will be in a SET system.

In the traditional plants, individual operators are responsible only for making their daily quota of parts. If operators work at different rates, or if problems are encountered somewhere in the sequence, inventories of partially assembled components begin to accumulate. Inventories may also be accumulated deliberately, to ensure against the

possibility of running out in the event of a machine breakdown or other contingency. This traditional method of operating can be called the "just in case" approach, as opposed to the "just in time," or pull, system, which simulates a machine-paced assembly line in the absence of machine-pacing. In a pull system, an operator does not begin work on a new piece until the next in line signals that she is ready for another piece. In this way, the operators at the end of the process "pull" a product in process through the line, and no inventory of product in process accumulates between stations. An operator who is slow or has a problem is visible because those behind her are sitting idle. The operator's control over pacing is reduced as the flow of production is evened out and as the amount of inventory is reduced.

A major problem with the traditional system concerns the cost of financing extra inventory. In the mid-1980s, the value of Hi-Tech's inventory was becoming unacceptably large. A 1984 memo from the president directed top managers to plan to reduce current work-in-process inventory by fifty percent, and to report such plans within thirty days.

Another drawback to the traditional system, particularly in producing certain sensitive equipment, arises from damage to parts that are stacked near the assembly lines. For example, dust, static electricity, and bumping can destroy sensitive components. For this reason, the pull system can improve quality while also reducing cost of production.

In the traditional system, the accumulation of work in process also means longer cycle times in manufacturing. For instance, the cycle time for production of a particular component at a traditional Hi-Tech plant in the United States was found to be sixty-six hours. In contrast, at one of the company's Asian plants, operating on the pull system, the same component could be produced in nine hours. As a result, it was actually faster to produce the piece in Asia and ship it to the United States than to produce it in the United States. Longer cycle times mean slower response to customers and greater difficulty competing for market share.

To prepare them for the new system, Hi-Tech has put production workers through classes in "short cycle manufacturing." Here they are told why and how their jobs will be restructured. Instead of focusing on making their daily rate on their individual machine or manual assembly operation, they are to become interdependent problem solvers. The course develops the image of inventory as a river whose level has to be reduced, and

production as a boat on the river. Rocks in the river represent all the problems impeding production, discovered as the water level falls and the boat founders on them. Examples of rocks are machine down time, missing parts or tools, defective materials, long changeover times, poor floor layout, engineering change orders, inaccurate paperwork, and inspection delays. Hitting a rock means production stops somewhere, and everyone else on the line has to stop, too, because no one is allowed to build up an inventory of subassemblies. At that point, operators are supposed to get busy breaking up rocks by not only solving the immediate problem, but also going after other problems that interfere with production.

The new style of production gives non-salaried employees more responsibility for quality control. Accordingly, many Hi-Tech production workers have been given classes in statistical process control. To facilitate group problem solving, they have also been given classes in interaction or communication skills.

General Skill Demands for Problem Solving Production Workers

Hi-Tech has made a systematic effort to upgrade basic literacy skills of production workers in connection with the change in manufacturing methods. The impetus for the new corporate policy began with the founding of a new plant in 1985. Initially, the plant had been scheduled for construction overseas, but domestic managers wanted to locate it in the United States. To make it succeed, they knew they would have to abandon traditional U.S. manufacturing methods. One corporate policy they wanted to change prohibited testing applicants for employment; this prohibition was based on fear of affirmative-action lawsuits. The managers involved in the 1985 new plant startup succeeded in "bludgeoning" the corporate counsel into permitting them to administer a written basic skills test. The new plant went on to become a huge success, and managers in other parts of the company began to emulate its new practices, including testing.

To prevent proliferation of various testing procedures, the director of testing at corporate headquarters commissioned a validation study to establish that production workers' scores on commercially available standardized tests did in fact correlate with supervisors' ratings of their performance. Scores on reading, mathematics, and visual acuity were found to predict supervisors' ratings of workers' "learning and problem-solving ability," "communication," "work quality," and "work productivity."

Subsequently, Hi-Tech developed its own proprietary test battery, which we will call the Technological Employment Skills Test (TEST). TEST items ostensibly are more related to actual work at Hi-Tech, and are, therefore, felt to be more accurate and less vulnerable to legal challenge. TEST has four subtests, which include reading comprehension and practical arithmetic.

Since the start of 1989, all new hires have been required to pass the company's test. Top management believes that all jobs within the company soon will require at least the level of literacy measured by TEST. After TEST was formulated, it was initially offered to current employees on a voluntary basis, and basic skills classes were offered one-half on company time and one-half on workers' time. In 1990, TEST, and classes for those not passing, became mandatory for existing workers. Now that classes are mandatory, they are scheduled entirely on company time in order not to violate the Fair Labor Standards Act.

So far, Hi-Tech has not set a limit on the amount of time employees have to attain a passing level. However, TEST has engendered considerable anxiety among existing employees, especially among older workers with little formal schooling, and among those with limited proficiency in English. One obvious concern is what will happen to workers who fail to pass after repeated attempts. Another concern is who will get to know their scores (employees are not told their own scores).

To allay these concerns, Hi-Tech is providing extraordinary support and incentives for existing employees who have difficulty passing the test. For example, in one unit, forty-three people did not pass when the test was first given. Managers offered a cash incentive of $3,000 for passing the test. In 1990, a teacher was brought in to give four hours of English instruction each morning to eleven members of this group who had still not passed; they were also given support to speak English while they worked in the afternoon.

Within the company, there has been debate about the new standards. Some argue that the new standards are still not high enough. Others argue that they are too high, resulting in some new hires who are more literate than their supervisors, and who may be dissatisfied with the majority of jobs in the company that have not yet been reorganized into

a SET system. Some top managers see this as a transitional problem, which they try to minimize by not raising skill standards too far in advance of job redesign.

In contrast to Hi-Tech, Together Manufacturing, which is considerably farther along in employee involvement, places much less emphasis on testing general skills. The initial hiring of team members did not include any type of basic skills test, though applicants for new jobs now take a thirty-minute mechanical aptitude test and a twenty-minute basic mathematics test. Spoken English is required, but written English is not. Some members cannot read or write English or do basic mathematics. Although some managers report that the lack of literacy hinders participation in training and the suggestion program and prevents promotion to team leader, opinions about this vary. Presently, a high school degree is not required, and the company places more importance on simulated tests of production work and on previous work experience than on formal schooling.

New applicants at Together Manufacturing are judged on the basis of an assessment that takes three half-days. The assessment includes simulations of teamwork (e.g., discussing specific problems, making decisions, and suggesting improvements as part of a group), assembling a Lego model, and performing jobs similar to those on the assembly line. Candidates are scored on their team orientation, interpersonal skills, and task orientation in the teamwork exercises, and on efficiency and quality in the production exercises. The production tests are especially important to ensure that the candidate has the strength, endurance, and dexterity to perform the physical labor involved in heavy manufacturing. Job candidates are also interviewed by team leaders and first level managers.

To some extent, teamwork can compensate for individual deficits in basic literacy at Together Manufacturing. An example from a training module describes how one team member had another one write up a suggestion to design a new chute for easing pick-up of an assembled piece. A third team member did the necessary mathematical calculations, the team leader drew the diagram, and the first level manager gave advice. The suggestion was awarded points for saving labor time and improving safety.

The success of Together Manufacturing in eliciting useful suggestions from team members despite some members' lack of formal literacy skills may demonstrate the importance of what cognitive scientists call situated intelligence (Lave, 1988; Scribner &

Stevens, 1989). Evidently, workers can learn how to operate the production process, and can devise methods to improve it, without high levels of fluency in symbolic language.

New Incentives for Acquiring Firm-Specific Skills

While some companies are concerned about general skills such as literacy, others are using innovative compensation plans to encourage acquisition of firm-specific skills and knowledge. We observed such a plan at Valley Life, which reorganized its internal operations in 1984. Approximately thirty employees from the Premium Accounting, Policy Issue, and Policyholder Service units were combined into a single Customer Service unit. Seventeen job titles were consolidated into one: Customer Service Representative. Within the unit, employees are organized into four teams, each responsible for serving a particular geographic region. Customer Service teams must perform the whole range of functions previously done in Premium Accounting, Policy Issue, and Policyholder Service. Within a team, any representative may perform any function she knows how to do. (The group is entirely female.) However, since employees who came from these three separate units possessed different sets of skills, no single employee knew how to perform all the team's functions. Cross-training was necessary in order to prevent bottlenecks. Instead of providing this cross-training in formal classes, Valley Life is encouraging team members to teach each other.

To motivate each Customer Service Representative to learn all the procedures, the company has designed and implemented a "Pay for Learning" system. The ratio of potential top to bottom pay for Customer Service Representatives is approximately two to one. To climb the pay scale, an employee must rate herself "100 percent qualified" on the range of specific tasks performed by the teams. Self-ratings must be reviewed by the team and by management and are subject to reversal if errors in a particular procedure are later traced to an employee who has claimed competence in that procedure. The amount of additional pay awarded for mastering each task or procedure is stated in terms of the relative amount of time required to achieve mastery. For example, knowing how to process address changes is worth two "weeks" and knowing how to convert a term insurance policy to a whole life policy is worth sixteen "weeks." The entire set of skills amounts to 321 "weeks."

The new Hi-Tech plant that began the company's current policy of literacy testing has also developed a system of skill-based pay. By certifying their proficiency in additional parts of the production sequence, operators can increase their base pay from approximately $320 to $430 per week. In addition, operators can earn merit increases by receiving favorable reviews from their supervisors on attendance, flexibility, and contribution to problem solving.

Skill-based pay systems tend to evolve over time. One problem is that employees eventually learn everything in the "curriculum," so new learning objectives have to be added. Another is that there may be limited opportunities to become proficient in certain operations that take a relatively long time to master. There may also be a tendency to sacrifice depth for breadth, as workers try to learn as many things as possible.

We observed these problems in a company that was not included in the current study. A skill-based pay system that existed at one plant since it was opened in 1974 has undergone three major revisions to overcome these problems. The third revision was being coordinated in 1988 by an hourly employee. Her performance of this job that was normally managerial qualified her for a higher rate of pay under the existing skill-based pay system!

Skill-based pay does not currently exist at Together Manufacturing. Both union leadership and high-level management have not favored skill-based pay, which they believe would raise questions of fairness without improving incentives or flexibility. The company relies on security and nonmonetary recognition to motivate workers. In addition, lower-performing workers are offered assistance from managers to improve. To the extent that there are external incentives for learning at Together Manufacturing, they are in the form of peer pressure from other team members who want to improve the team's performance and flexibility. However, it remains to be seen whether nonmonetary incentives alone will suffice to maintain the desired level of motivation.

Motivation and Employment Security

So far, Valley Life has relied upon pay for knowledge, which may motivate employees to learn new skills, without eliciting work effort. Some team members in the

Customer Service group have complained that other team members are absent too often or do not work hard enough. The Customer Service manager is now considering the addition of a performance element to the compensation package. Likewise, at Together Manufacturing, some team members have complained about others' lack of effort. However, the union at Together Manufacturing has so far opposed any performance-based pay.

Together Manufacturing is remarkably successful in getting employees involved in continuous improvement, despite some team members' low level of formal literacy. The company does pay employees for successful suggestions, but so does Hi-Tech, which receives far fewer. Of the various ways that Together Manufacturing has been able to motivate its team members, one of the most important seems to be its highly visible commitment to employment security. The union contract at Together Manufacturing stipulates that, before laying off any employees, the company will take such measures as reducing the salaries of its officers and management. This contributes to the perception that everyone is in the same boat, and is committed to keeping it afloat. During a recent downturn in sales, Together Manufacturing departed from industry practices and refrained from any layoffs, making the perception a reality for the workforce (Brown & Reich, 1989). As we shall see, other companies have not been so successful in this regard.

THE TRANSFORMATION OF EMPLOYMENT SECURITY

An employee's source of security can take several forms such as length of service providing a buffer from layoff (seniority security); professional, craft, or firm-specific training that ensures a demand for the person's skills (skill security); a contractual obligation to pay the individual whether employed or not (income security); or an explicit obligation to provide employment except under extreme financial conditions (employment security). These forms of security are not mutually exclusive, and two or more of them may be practiced at any given time.

Security provided by seniority and by a craft is discussed in Kerr (1977). Professional training provides security of employment within an occupation, rather than with an employer, while firm-specific training makes a worker more secure with the

employer but not within the general labor market. Income security (i.e., supplemental unemployment benefits, guaranteed incomes) is part of some major collective bargaining agreements such as in the automobile sector. Employment security is usually associated with the Japanese employment system (e.g., see Aoki, 1988). However, it is provided in the United States by some collective bargaining agreements such as the United Automobile Workers-New United Motors Manufacturing, Inc., contracts in 1986 and 1989 and the Communications Workers of America-Pacific Bell contract in 1986. A variant of employment security is an understanding that employment will be provided if possible (i.e., "employment obligation"). Such implicit pacts are practiced widely in the non-union electronics industry (see Kochan, MacDuffie, & Osterman, 1988).

Employment security is a central feature of SET, where firm-specific skill security is maintained by employees' abilities to solve problems and to learn several operations. Security here focuses on the company. Of course, the most secure system for workers is a high demand economy with low levels of unemployment (i.e., "macro security"). Security provided by a robust economy is not covered in this paper, although it certainly affects the ability of companies to provide security to their employees.

The goal of combining security and training commitments is to create a system in which employees and the company share long-run goals of profitability and high productivity translated into high wages. In contrast, JAM usually includes a combination of income security and seniority security along with narrowly-defined skill security for craft workers, whose training is characterized by apprenticeship programs within a well-defined trade. Non-unionized firms frequently offer some form of seniority security and skill security, and a few provide income security or employment obligation that can be changed arbitrarily.

Employment Security at Traditional Manufacturing

In a highly adversarial situation marked by a long history of distrust, each side in a JAM plant will fight to retain old control and protective mechanisms if a SET system is attempted. The union will strive to gain more security without increasing effort, while the management will strive to increase workers' efforts without increasing security. Increasing effort includes learning and applying new skills as well as increasing the speed of

traditional operations. New skills include thinking (e.g., solving problems, collecting data, inspecting own work) and communicating (e.g., making suggestions, teamwork). SET cannot evolve in such a situation of extreme distrust, and attempts to implement it may result in another round of adversarial maneuvers with few (if any) improvements accomplished.

We observed this scenario at a plant that we will call Traditional Manufacturing. The union had already gained considerable income security and some employment guarantees, and long-run surplus capacity prevented the company from granting further improvements in security. In fact, the income security provisions made a transition to employment security expensive in the short run to the company and less appealing to workers, especially those with more seniority. The company had to be willing to give up using the Unemployment Insurance system to subsidize short-run layoffs for retooling and inventory control, while the union had to be willing to give up paid time off for these short-run lay offs, in order to gain the possible long-run gains associated with employment security.

Income security allows the company to maintain control over the size of the workforce, but at the cost of not having flexible use of workers, since layoffs are by seniority. Employment security allows the company more flexibility over the use and skills of its workforce, but less flexibility over the size of the workforce. Traditional Manufacturing was relying on employees' cooperation to reduce costs and improve quality in hopes of reducing the number of plants that would be closed in the coming years. However, this strategy put the more senior workers' short-run and long-run interests in conflict and it put senior and junior workers' interests in conflict.

Employment Security at Together Manufacturing

This stalemate contrasts with the case of Together Manufacturing, where genuine changes have been made toward a SET system; where the union and employees accept less control over job classifications and absenteeism and more responsibility for enforcing the employees' obligations; and where the management accepts employment security, training obligations, and some shared decision making. Work effort has increased because the line

is down less often, employees are absent less (and therefore paid more), and they no longer have paid time off while unemployed for short periods.

Overall, Together Manufacturing and the union traded employees' commitment to increased effort, training, and continuous improvement in exchange for long-run employment security. Traditional Manufacturing's management tried to capture workers' knowledge and increased effort for already-granted provisions of income security with no improved employment guarantees. Together Manufacturing has been successful in the transformation, while Traditional Manufacturing has not.

Diminishing Employment Security at CommEx

CommEx provides an example of a company that abandoned its progress toward replacing a JAM system with a SET system as its economic environment became more competitive. Although it is in a regulated industry, CommEx has experienced a major change in its regulatory environment from a cost plus pricing system to a system that allowed the company to keep a portion of cost reductions. Since earlier changes in regulations were allowing new entrants into some markets, CommEx had already become oriented to lowering prices rather than providing on-demand service.

CommEx's technological environment was also changing. The company has been implementing new labor-saving technologies over the past decades. This process of technological change has intensified over the past six years and does not appear to be diminishing. Technological change confronted employees with a choice: learn the new technology in the old job or move to a new job (and possibly new location) as needed. Although learning a new technology is not a new experience for many of the workers, the extent of the changes has increased. More importantly, the workers had become used to secure—"womb to tomb"—employment that did not require them to change job titles, much less location.

In 1986, CommEx and its major union negotiated formal employment security provisions in the contract to protect workers from these regulatory and technological changes. Security was conditional upon employees meeting standard performance criteria and accepting reassignment, retraining, and relocation. In return, compensation included

an annual bonus and no cost-of-living adjustment (COLA). At the same time, union-management committees were formed to cooperatively reassign or retire workers on a voluntary basis in a major downsizing effort. Also, about the same time, CommEx was trying to persuade workers to undertake career development on their own time in order to prepare for movement to other jobs in the future.

During the three-year life of the contract, no layoffs occurred and fewer than fifty employees were forced to relocate or resign, although many workers voluntarily transferred to new jobs or retired. The non-salaried workforce declined by seven percent, which followed upon a fourteen percent decline in the non-exempt workforce in the previous two years. (The CommEx workforce peaked in 1981 and has been declining continuously ever since.)

At the next round of negotiations in 1989, CommEx was no longer willing to have transfers on a voluntary basis only, even though (in an interview prior to the strike) management put the number of estimated surplus employees at only 0.6 percent of the unionized workforce. A strike in 1989 destroyed the basis for cooperation, and the company has now begun a more forceful relocation and downsizing process. Union involvement in the complex process has reverted to the traditional role of processing grievances in response to actions that appear to violate the contract. Between September 1989 and the end of 1992, CommEx predicts that, after allowing for attrition (nine percent) and new opportunities (four percent), eight percent of the workforce will be declared surplus, that is, subject to termination.

Attrition includes retirements, terminations, leaves, transfers out, promotions, and expirations. The entry-level job, which has many workers and high turnover, accounts for one-third of the estimated attrition and three-fifths of the estimated new opportunities. Overall, non-entry jobs were forecast to expand by 814 and to have a surplus of 3,689.

Security has been reduced in several ways at CommEx. Employment security now includes the requirement that employees accept involuntary reassignments, including downgrades and non-commutable transfers. If employees accept a downgrade during the voluntary phase of the process, they receive up to three years of wage protection, based upon seniority. If employees quit during the voluntary phase, they receive severance pay based on years of service. Employees in surplus job titles are also eligible for an early

retirement plan, which adds three years to their service and age for calculating retirement benefits.

In addition, seniority security was reduced by decreasing the allowable transfer area for replacement of least senior employees ("bumping rights"). Few workers have skill security, as most skills are not transferable because no other comparable employer exists in the area, and some workers' skills have become obsolete.

However, the union has prevented CommEx from reducing security still further. First, CommEx had wanted to include the requirement that employees continually upgrade their knowledge and skills in order to retain employment security. This would have added a continuous education requirement to standard performance. Second, CommEx wanted to drop all bumping rights in the transfer process. Third, CommEx had wanted reassignment to be based on narrow qualification ranking (with seniority ruling within the groups) rather than all employees who are broadly qualified being in the same pool (with seniority reigning). This would have provided more skill security and resulted in less retraining. This provision is controversial within the union because it could result in lower-skilled workers with more seniority being chosen for training over those higher-skilled workers who have less seniority.

One might characterize the situation as CommEx thinking that it was not receiving sufficient flexibility in deploying its workforce for the security it provided. CommEx was experiencing healthy growth, however, and net income was up almost thirty percent in 1989. Nonetheless, CommEx apparently thought it could no longer afford employment security because of the rapidly changing technology and possibly volatile product demand as the market was deregulated. (This goes against the Aoki model, in which these are the characteristics in which SET is most likely to be efficient.) At CommEx, union-management cooperation focused primarily on the downsizing issue; other parts of SET such as reduced number of job classifications, employee involvement in decision making, and pay for knowledge were absent. Although CommEx has some employee involvement programs, they are scattered and do not involve the union. The company is trying to expand its program of employee teams to make quality improvements. While CommEx does extensive training, both on the job and in the classroom, the company has recently been urging employees to get more education on their own time.

It is too early to judge the impact of CommEx's retreat from SET. CommEx may find that the costs in effort, morale, and quality resulting from decreasing security and decreasing union involvement in decision making are higher than anticipated. As one employee said, "The morale here is terrible. Since they announced surplus, everyone feels a lot of stress. It's like going through a divorce. Before you felt valuable to the company; now you feel like they don't care." On the other hand, CommEx may find the opposite—they may find that the company was providing more security than needed to provide efficient, high quality service. We expect that this ongoing case study will shed light on the importance of the economic environment in determining the feasibility of providing security of employment.

Loss of Employment Security at Valley Life

On a smaller scale, downsizing has also taken place at Valley Life. The company had a long history of employment security; it did not even lay off employees during the Depression of the 1930s. Nevertheless, in 1989, a new CEO declared it was necessary to cut payroll. Given Valley Life's smaller size and absence of a union, this was accomplished much more quickly than at CommEx. Approximately sixteen percent of the company's employees took early retirement, accepted a voluntary severance package, or were asked to leave. Within the Customer Service group, the number of Customer Service Representatives was reduced from twenty-seven to twenty-two. In addition, the Customer Service teams had to absorb the functions of a four-person group that had been responsible for distribution of mail and documents; that group was eliminated. The company indicated that this downsizing was a one-time event, and that employment security would continue for the remaining employees.

Employment Security at Hi-Tech, Inc.

Hi-Tech has a strong employment security policy for senior hourly employees. The company will not dismiss a senior employee except for reasonable cause, poor performance, or if the employee refuses training. In the event of layoff, company policy is to ignore whether an employee has passed the basic skills test, and to determine the order

of layoff strictly by seniority. Layoffs of junior workers have occurred in older plants where product demand has slackened.

Questions of employment security have not arisen in factories which are increasing their workforce to keep up with growing demand. Newly hired employees have passed the basic skills test as part of the hiring process, and security will not become an issue until product demand decreases.

The transformation to SET in a new factory setting is relatively easy because new technology is installed at the same time and all employees have passed the basic skills test. However, in a traditional factory, the transition to SET is more difficult. The traditional production process and concomitant management style cause problems that cannot easily be solved by production workers. For example, operators say they frequently must go looking for parts when they run out, and product design changes are frequently made without informing the operators and without providing new instructions promptly. Many of the tasks in the traditional factory will eventually be automated, but they are required to be done by hand until then.

The company has been stymied in some of its efforts to automate, especially with generalized machines that insert many different components. Its experience has been that dedicated machines and lines work better, and these are feasible with products (or components) that are sold (or used) in large quantities. In some instances, generalized automated machinery has been replaced by a combination of dedicated machinery and some tasks done by hand to customize the product.

This splitting of production into smaller homogeneous batches results in the specialization of workers and processes, and it contrasts with the alternative approach of using a large scale flexible process with frequent changeovers. The "job shop" in this case has been accomplished by forming mini lines that specialize in a few products. Although employees are organized into teams and make decisions within their mini lines, the specialized nature of their work limits the amount of training and flexibility needed and it increases the time spent on routine tasks, which can be done quickly and reliably by a practiced operator.

At Hi-Tech, the production and workforce needs cover a wide spectrum, and no one system can fit the diverse situations. Yet a clear trend toward mini job shops with dedicated machinery combined with customized hand work is emerging. In this situation, security might not be necessary for hourly employees except technicians, who will continue to embody a large amount of specific skill in their knowledge of the equipment and their troubleshooting capabilities.

Nevertheless, top management continues to emphasize its commitment to employment security for senior hourly employees. They are seen as loyal, "tried and true," and as positive role models for new employees. The responsibilities of hourly workers will continue to evolve, with those who have passed the company's basic skills test being given a larger role in statistical process control, troubleshooting, software adjustment, and in training other employees. This differentiation, however, does not presently entail any reduction in employment security guarantees at Hi-Tech.

The Role of the Union

Representation by a union resulted in a different process of transformation to SET. When the union is involved in the transformation, the employees have more input into the transfer and selection process of workers for the new factory as well as into the training programs. Although the union involvement will slow down the process, the union will also act as a counterweight to the company's propensity to require nonessential education on the employee's own time and the propensity to require higher standards in hiring than will be used by all employees on the new job.

In addition, the union policies on transferring workers help enforce social norms that can help to maintain good morale. In a new, non-union factory, one employee, who was her group's most skilled operator, was transferred back to the traditional factory because she failed a basic skills test after being in the new factory several months. Her supervisor explained that he was afraid she might not be able "to work with the group on problem solving in the future," without being able to pass the written test. This decision, which was based on a hypothetical assumption about the need for written literacy rather than on the employee's proven abilities, would have been prevented (or grieved) in a union environment.

Our five case studies do not indicate that the presence of a union is either necessary or sufficient to ensure a successful transition to the SET system. Two of the unionized companies, Traditional Manufacturing and CommEx, were experiencing more difficulties with the transition to SET than two of the non-unionized companies, High Tech and Valley Life. But, as we have seen, Traditional Manufacturing and CommEx did not have all three elements of SET in place, and were having difficulties for these reasons. At Together Manufacturing, the most successful of our companies in making the transition, all three elements of SET were in place and the involvement of the union clearly facilitated the transition to the SET system (Brown & Reich, 1989).

CONCLUSIONS AND IMPLICATIONS FOR SCHOOLS

Our field work has identified variation across companies and across plants within companies in the degree of successful transition to a SET system. A working SET system is in place at Together Manufacturing and Valley Life; Traditional Manufacturing has been unable to put together all the elements of SET; the plants that we observed at Hi-Tech range from successful SET factories to traditional SAM ones; and CommEx has been in retreat from SET.

We have observed the maintenance of strong employment security practices at Together Manufacturing and Hi-Tech, repeated decreases in the workforce and weakening of employment security provisions at CommEx, and a one-time downsizing at Valley Life. Together Manufacturing's commitment to employment security has been successfully tested by a period of reduced product demand, but Hi-Tech's has not as yet.

Hi-Tech has instituted a new basic skills test as a minimum standard for employees in the participatory "factory of the future." In contrast, Together Manufacturing and Valley Life have succeeded in transforming their work processes with employees who might not pass Hi-Tech's test. These two companies have made learning an explicitly recognized part of daily work and have qualitatively transformed worker loyalty and motivation.

Although CommEx made initial commitments to employment security and worker retraining, its efforts at employee involvement have been limited. CommEx's response to

rapid technological change has not been to make a one-time reduction in its workforce, which would have been seen, as at Valley Life, as still retaining employment security for the remaining workforce. (A similar experience is reported for the case of Digital Equipment Corporation [DEC] by Kochan et al., 1988.) Instead, CommEx has instituted repeated reductions that hamper employee involvement and reduce considerably the long-run level of employment security provided to its employees. CommEx's employment system is struggling as a result.

Although we do not have sufficient financial data to present even a rough estimate of the dollar cost of transition to SET, the experiences of these companies indicate the kind of investment required for a successful transition. This may involve new technology and equipment, but it need not. Hourly employees and supervisors must be trained for their new roles. What is required is sufficient time to overhaul the existing system so that supervisors are not feeling continually pressured to meet their monthly output quotas and, therefore, ignoring initiatives from above or reverting to traditional practices. New procedures have to be visible to make a consensual understanding that will be followed. The infrastructure of employee involvement has to be built upon an investment in communications.

Companies that have successfully instituted SET systems have put all three parts of the SET triangle in place (see Figure 1). Instead of organizing work so that employees do a single task in a production process, monitored by a supervisor, companies are asking workers to be parts of active, semi-autonomous teams, to be involved in problem solving, job rotation, quality control, and continuous improvements. These new systems require some cognitive skills such as an ability to write suggestions or to perform elementary statistical analysis of defect patterns. More importantly, however, the new systems involve qualitatively different skills such as relational capacities for working in or leading a team, and qualitatively higher commitments between the workers and the company.

The formation of such skills and commitment require enhanced levels of employment security, employee involvement, and training, which traditional organizations may not be prepared to provide without external assistance or without changes in the macro economy. Indeed, several recent reports have indicated that many companies are not uniformly instituting elements of SET. The continuing low level of job security provisions

in collectively bargained contracts is reported in Uchitelle (1989). Weakening employment security patterns are discussed by Osterman (1990).

The companies in our study report that they are still experimenting and making changes in their employment systems. Whether they or other firms increase or maintain a high level of employee involvement along with relatively high pay for hourly employees seems to depend on finding some solution to the problem of how to provide all three features of the SET system.

Implications for Schools

This research suggests three kinds of implications for schools. These pertain to the teaching of students in initial education, further education and training of adults, and the restructuring of the work process within schools themselves. We sketch these implications very briefly here.

With regard to the teaching of students during their initial schooling—K-12 and postsecondary—the description of the SET system reinforces the current widespread interest in making sure that students develop general capacities for problem solving, communication, and continued learning. These issues are discussed in greater detail by Raizen (1989) and by Stasz, McArthur, and Ramsey (1990). In addition, successful participation in a SET system requires positive motivation to think constructively about problems at work and how to make improvements in work processes. To develop these capabilities and motivations presumably requires a more team-based, project-oriented, problem-solving method of instruction. It would also be beneficial to include more school-supervised work experience in the curriculum, so that students can practice learning in the workplace. This is a formidable agenda for curricular reform.

In addition to preparing students for their future work, schools also have a role to play in helping currently employed adults adapt to changes in their workplaces. Community colleges are already active in upgrading basic literacy, teaching generic work skills such as communication and problem solving, and providing technical training for adults whose jobs are now demanding new or higher levels of skill and knowledge. Still, these arrangements are not always as efficient as they might be. Even community colleges,

as flexible and enterprising as they are, tend to use classroom instruction as their primary vehicle. This creates problems not only in scheduling, but also in the transfer of training from the classroom to the job. Traditional methods of cooperative education, which use experience on the job to achieve specific learning objectives, might profitably be expanded and adapted for the new market of adult learners at work.

Finally, SET can serve as a model for restructuring the work of teachers in schools and colleges. Most teachers already have greater employment security than other occupations, so this element of the model is already in place. Teachers also have relatively abundant opportunities for continued training, and, in most K-12 school districts, teachers even earn higher salaries as they accumulate post-graduate educational credits, so the training element also seems to be in place. What is clearly lacking for most teachers is employee involvement. In particular, teachers are seldom organized into semi-autonomous work *teams*. Currently, many efforts to "restructure" school governance are attempting to give groups of teachers more decision-making authority over such matters as curriculum, instructional materials, scheduling, evaluations of peers, and budgets. Teachers engaged in these experiments may also take more control over their own professional development, so that their continual training becomes more immediately relevant to improving the instructional process. Moreover, it seems likely that teachers who are themselves employed in a SET system will be more able to prepare students for that kind of work.

REFERENCES

Akerlof, G. (1982, November). Labor contracts as a partial gift exchange. *Quarterly Journal of Economics*, *97*, 543-569.

Aoki, M. (1988). *Information, incentives, and bargaining in the Japanese economy*. New York, NY: Cambridge University Press.

Aoki, M. (1990, March). Toward an economic model of the Japanese firm. *Journal of Economic Literature*, *28*(1), 1-27.

Arrow, K. (1972). Some mathematical models of race discrimination in the labor market. In A. Pascal (Ed.), *Racial discrimination in economic life* (pp. 83-102). Lexington, MA: D. C. Heath.

Becker, G. (1964). *Human capital*. New York, NY: National Bureau of Economic Research.

Borjas, G. J. (1988). Earnings determination: A survey of the neoclassical approach. In G. Mangum & P. Philips (Eds.), *The three worlds of labor economics* (pp. 21-50). Armonk, NY: M. E. Sharpe.

Brown, C., & Reich, M. (1989, Summer). When does union-management cooperation work? *California Management Review*, *31*(4), 26-44.

Cohen, S. S., & Zysman, J. (1987). *Manufacturing matters*. New York, NY: Basic Books.

Cole, R. E. (1989). *Strategies for learning*. Berkeley: University of California Press.

Commission on the Skills of the American Workforce. (1990). *America's choice: High skills or low wages*. Rochester, NY: National Center on Education and the Economy.

Commons, J. R. (1934). *Institutional economics*. New York, NY: Macmillan.

Commons, J. R., et al. (1918, 1935). *History of labor in the United States, Vols. I - IV.* New York, NY: Macmillan.

Dertouzos, M. L., Lester, R. K., & Solow, R. M. (1989). *Made in America: Regaining the productive edge.* Cambridge, MA: MIT Press.

Doeringer, P. B., et al. (1969). *Low income labor markets and urban manpower programs.* Report submitted to the Manpower Administration, U.S. Department of Labor, Washington, DC.

Doeringer, P. B., & Piore, M. J. (1971). *Internal labor markets and manpower analysis.* Lexington, MA: D. C. Heath.

Dore, R. P. (1973). *British factory, Japanese factory.* Berkeley: University of California Press.

Dore, R. P., & Sako, M. (1989). *How the Japanese learn to work.* New York, NY: Routledge.

Dumaine, B. (1990, May 7). Who needs a boss? *Fortune, 121*(10), 52-60.

Dunlop, J. T. (1958). *Industrial relations systems.* New York, NY: Holt.

Foulkes, F. K. (1980). *Personnel policies in large nonunion companies.* Englewood Cliffs, NJ: Prentice-Hall.

Foulkes, F. K. (1989). *Human resources management.* Englewood Cliffs, NJ: Prentice-Hall.

Gordon, D., Edwards, R., & Reich, M. (1982). *Segmented work, divided workers.* New York, NY: Cambridge University Press.

Jacoby, S. (1985). *Employing bureaucracy.* New York, NY: Columbia University Press.

Jacoby, S. (1990). The new institutionalism: What can it learn from the old? *Industrial Relations*, *29*(2), 316-340.

Katz, H. C. (1985). *Shifting gears: Changing labor relations in the U.S. automobile industry*. Cambridge, MA: MIT Press.

Kerr, C. (1977). The balkanization of labor markets. In C. Kerr (Ed.), *Labor markets and wage determination* (pp. 21-37). Berkeley: University of California Press.

Kerr, C., et al. (1960). *Industrialism and industrial man*. Cambridge, MA: Harvard University Press.

Kochan, T. A., Katz, H. C., & McKersie, R. B. (1986). *The transformation of American industrial relations*. New York, NY: Basic Books.

Kochan, T. A., MacDuffie, J. P., & Osterman, P. (1988, Summer). Employment security at DEC. *Human Resource Management*, *27*(2), 121-143.

Koike, K. (1988). *Understanding industrial relations in modern Japan*. Basingstoke, England: Macmillan.

Lave, J. (1988). *Cognition in practice: Mind, mathematics, and culture in everyday life*. New York, NY: Cambridge University Press.

Lazear, E. (1990). Pensions and deferred benefits as strategic compensation. *Industrial Relations*, *29*(2), 263-280.

Lincoln, J. R., & Kalleberg, A. L. (1990). *Culture, control, and commitment*. New York, NY: Cambridge University Press.

Mincer, J. (1974). *Schooling, experience, and earnings*. New York, NY: NBER/Columbia University Press.

Okun, A. M. (1981). *Prices and quantities*. Washington, DC: Brookings Institute.

Osterman, P. (1988). *Employment futures*. New York, NY: Oxford University Press.

Osterman, P. (1990). *Processes and prospects for employment security in the United States*. Unpublished manuscript. Massachusetts Institute of Technology, Cambridge.

Piore, M. J., & Sabel, C. F. (1984). *The second industrial divide*. New York, NY: Basic Books.

Raizen, S. A. (1989). *Reforming education for work: A cognitive science perspective*. Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Schultz, T. W. (1963). *The economic value of education*. New York, NY: Columbia University Press.

Scribner, S., & Stevens, J. (1989). *Experimental studies on the relationship of school math and work math*. New York, NY: National Center on Education and Employment, Columbia University.

Slichter, S. H. (1941). *Union policies and industrial management*. Washington, DC: Brookings Institution.

Soskice, D. (1990). Reinterpreting corporatism and explaining unemployment. In R. Brunetta & C. dell' Aringa (Eds.), *Markets, institutions, and cooperation: Labour relations and economic performance*. New York: New York University Press.

Stasz, C., McArthur, D., & Ramsey, K. (1990). *Teaching and learning generic skills for the workplace*. Berkeley: National Center for Research in Vocational Education, University of California at Berkeley.

Stern, D. (forthcoming). Institutions and incentives for developing work-related knowledge and Skill. In P. Adler (Ed.), *Technology and the future of work*. New York, NY: Oxford University Press.

Streeck, W. (1989). Skills and the limits of neo-liberalism. *Work, Employment, and Society*.

Turner, L. (1990). *The politics of work reorganization*. Unpublished doctoral dissertation, University of California at Berkeley.

Uchitelle, L. (1989, 9 January). Job security: A mirage for unions despite wage concessions of 80's. *New York Times*, p. A1.

U.S. Department of Labor, Bureau of Labor Statistics. (1990). *Real earnings in May 1990*. Washington, DC: U.S. Government Printing Office.

Wachter, M., & Wright, R. D. (1990). The economics of internal labor markets. *Industrial Relations*, 29(2), 240-262.