

WHAT WORKS AT WORK: OVERVIEW AND ASSESSMENT

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February 1996

SWP#: 3886-96-BPS

What Works at Work: Overview and Assessment¹

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(February 1996)

¹ The authors gratefully thank the National Center for the Workplace, the Alfred P. Sloan Foundation for its support for all our work in the Human Resource Network, and the Department of Labor for its support to Ichniowski and Kochan under contract number 41USC252C3.

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Abstract

This article discusses why it is difficult to measure the effects of management practices on organizational performance. In spite of these difficulties, a collage of evidence suggests that innovative workplace practices can increase performance, primarily through the use of systems of related practices that enhance worker participation, make work design less rigid, and decentralize managerial tasks. A majority of U.S. businesses have adopted some innovative work practices. However, only a small percentage of businesses have adopted a full system of innovative practices. We outline several constraints on the diffusion of new work practices, and suggest directions for future research.

What Works at Work: Overview and Assessment

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The past two decades have witnessed considerable experimentation and research on new work practices and human resource policies. Why have businesses adopted them? What has been their impact on performance?

This study has two primary goals. First, it reviews features of the research designs employed in existing studies on workplace innovations. This review of methodological issues is meant to serve as a framework for evaluating existing studies and to encourage new research on workplace innovations to incorporate the most persuasive research designs possible. Second, this study reviews the findings from a broad set of studies which employ different research designs. Because different research designs have their own particular strengths and limitations, we highlight as especially noteworthy those results which emerge consistently from different studies and summarize themes on which a considerable body of work agrees. Much more than a typical symposium introduction, this article presents a critical review of the strengths, weaknesses, and results of research on what works at work.

The Nature of Workplace Innovations

The term "innovative" work practices has no settled meaning. For many scholars and practitioners it refers to employee involvement efforts such as work teams (e.g., Katz, Kochan, and Gobeille, 1983). For others, it means employee participation in the financial well-being of the company such as profit sharing, employee stock ownership, or pay-for-performance. Still others have in mind flexible and broadly defined job assignments, employment security policies,

or improved communication and dispute resolution mechanisms. Often, managers and workers refer to a special workplace "culture" that is not easily captured by the measurement of a single work practice.

What these diverse work practices have in common is that they depart from the traditional work systems and labor-management relationships that evolved in the U.S. out of the "New Deal system of industrial relations" (Kochan, Katz, and McKersie, 1986). The traditional system is characterized by tightly defined jobs with associated rates of pay, clear lines of demarcation separating the duties and rights of workers and supervisors, decision-making powers retained by management, and communications and conflicts channeled through formal chains of command and grievance procedures. Current workplace innovations seek greater degrees of flexibility in work organization, cooperation between labor and management, and worker participation in the decisions and financial well-being of the company. In this article, we use the terms "workplace innovations" or "new work practices" to refer generally to all these kinds of non-traditional work practices that have become increasingly common among U.S. businesses in recent years (Ichniowski, Delaney and Lewin, 1989; Lawler, Mohrman and Ledford, 1995; Osterman, 1994).

Theoretical explanations

Elaborate theoretical explanations have been developed to explain why new high-skill, high-involvement workplaces may be more effective (see Levine, 1995 for a review). These can be summarized into theories that focus on the effort and motivation of workers and work groups and suggest that individuals work harder, and theories that focus on changes in the structure of organizations that improve efficiency.

High-involvement workplaces may lead workers to work harder if the work is less onerous. Workers may enjoy work more when the characteristics of the job make work interesting and ensure the work provides feedback and rewards. They are also less likely to resent a job if they help design it.

Innovative work practices may also lead workers to work more efficiently. Workers often have information which higher management lacks, especially as to how to make their jobs more efficient. Further, greater participation permits a variety of different views to be aired, and many lead to workers redesigning their jobs so that they can better coordinate their efforts. Indeed, Berg, Appelbaum, Bailey and Kalleberg (in this issue) conclude that in the apparel plants they study, "working smarter" is more important than any changes that makes work more interesting or enjoyable. Work groups may encourage both working harder and working smarter if their norms change from discouraging high performance, for example punishing "rate busters," to rewarding high performance. These changes, in turn, are more likely if the group is rewarded for its collective success, perhaps with bonuses or gainsharing.

Innovative work practices can also produce structural changes that improve performance independent of their effects on motivation. Cross training and flexible job assignment can reduce the costs of absenteeism; decentralizing decision-making to self-directed teams can reduce the number of supervisors and middle managers required while improving communication; training in problem solving, statistical process control, and computer skills can increase the benefits of new information technologies; worker and union involvement in decision-making can reduce grievances and other sources of conflict and thereby improve operating efficiencies. These kinds of organizational changes that are often associated with employee involvement processes make it difficult to isolate any single causal mechanism that produces their effects on economic performance.

Thus, theories of new work practices imply that these new arrangements can cause workers to work harder and share more ideas. Further, they can make organizational structures more efficient regardless of any effects they may have on worker motivation. In either case, companies with these practices should enjoy higher productivity and quality (as in Berg et al. and Kelley, in this issue), leading to lower costs and higher product demand, all else equal. But any savings may be offset by the expenses of the employee involvement programs, such as the costs of extra meetings, and the costs of related human resource policies. Cost reductions and stronger demand, holding other things constant, should lead to higher sales and earnings (Dunlop and Weil,

in this issue), and ultimately better performance on financial measures such as cash flow and return on investment. Ultimately, these financial improvements should be reflected in the value of the enterprise's stock (Huselid and Becker, this issue).

The performance measures vary widely, from those close to the workplace such as worker stress (Berg et al.), to intermediate outcomes such as machine time per piece in the machining industry (Kelley), to outcomes quite distant from the workplace such as stock market value (Huselid and Becker). For public policy, knowing the effects of innovative work practices on workers and productivity may suffice. For private-sector decision-makers, such as investors and managers, financial and stock market returns are the arbiters of success. Because these latter groups have far greater influence on management practices than do union leaders or policy-makers, we need to know how work practices affect the bottom line. Unfortunately, as discussed below, a number of factors imply that even fairly successful workplace innovations may have effects on financial performance that are difficult to detect.

Recent research further suggests that high-involvement work practices are more effective when "bundled" with supporting management practices (Milgrom and Roberts, 1990, 1993; Holmstrom and Milgrom, 1994). Workers cannot make good decision without sufficient information and training, and they are unlikely to make suggestions if they feel this will cost them their jobs or reduce their pay (Levine, 1995, ch. 3). Dunlop and Weil and Pill and MacDuffie (in this issue) shed light on theories of "internal fit," that is, how bundles of work practices support or fail to support, each other.

The external context also matters. For example, bundles of work practices that support a highly flexible work process may be effective in a product market with rapidly changing demands, but have fewer advantages in a stable market. Dunlop and Weil find evidence that the organization's environment in the apparel industry has affected who adopts innovative work practices, and how effective they are. More generally, they argue that new work practices must be analyzed within the context of the organization's overall strategy and market environment, not as an isolated human resource policy initiative.

Types of Workplace Research

It may be useful to place the research reported here in broader perspective. Empirical research began with laboratory experiments. These identified the theoretical principles that might underlie effective work practices such as participation and goal setting. Unfortunately, what works within a short-term laboratory experiment (often with college students) may not work in the real world. Early field experiments in workplaces were more realistic, but usually were confined to single departments, lacked controls, and lasted for short periods of time (e.g., French and Coch, 1948; Whyte, et al., 1955).

The late 1960s and 1970s saw experiments in which various forms of employee involvement were introduced into entire plants. The effects of these workplace changes on both various outcomes such as attitudes, production, accidents, and turnover were carefully monitored, both qualitatively and quantitatively and over considerable periods of time (e.g., Marrow, Bowers, and Seashore, 1967; Goodman, 1979). These studies raised most of the issues of current concern, such as resistance to workplace innovation by both unions and management, and the importance of having appropriate training and compensation practices. The last few years have seen a innovative wave of case studies, many based on Japanese transplants (Fucini and Fucini, 1990; Adler, Goldoftas, and Levine, 1995; Graham, 1995). These case studies provide insight and suggest hypotheses, but it is difficult to know how well they generalize.

Recently, workplace research has expanded to include surveys (often rather small ones) of firms, lines of businesses, and establishments. By contrast with case studies, surveys cover more than one establishment and their purpose is more often to test theories than to generate them. These surveys can be grouped under three headings.

First are the major government-sponsored British (Millward, Stevens, Smart, and Hawes, 1992) and Australian (Callus, Morehead, Culley, and Buchanan, 1991) surveys of workplace practices which involve stratified random samples of large and middle-sized workplaces. With high response rates (87% in the Australian case), these provide a wealth of data about the incidence of various practices, but tell us little about their impacts. The closest US equivalents of

these studies are a survey conducted by the GAO with two follow-ups by a University of Southern California group (Lawler, et al., 1995); a line-of-business survey by Columbia University researchers (Delaney, Lewin and Ichniowski, 1988), Osterman (1995), and the two waves of data analyzed by Huselid and Becker. Most of these US studies are based on firms or lines of businesses, permitting analysis of financial performance. At the same time, most of the companies implement a mixture of work practices among their multiple workplaces, making it difficult to determine the particular impact of practices which may be employed in only some of the workplaces. In addition, rather low response rates lead to concerns about these studies' generalizability. (Osterman surveys establishments, gaining greater precision in measurement while foregoing most measures of overall organizational performance [1994].)

Each study in this symposium has some measure of incidence (how frequently a given practice is employed). When incidence studies are repeated, it becomes possible to study the adoption and cessation of work practices. For example, Pil and MacDuffie examine the adoption of work practices in the world automobile assembly industry. Adoption studies also provide a weak test of effectiveness; presumably, work practices that managers adopt are those that they expect to be successful. Studies of longevity often find that the half-life of many innovations is short, suggesting their effectiveness is often less than managers had expected (Drago, 1988; Eaton 1994). Similarly, Dunlop and Weil find that when innovative work practices in the apparel industry were introduced before related changes in customer relations, the innovations did not last long.

A second set of surveys are matched sets of workplaces in more than one country (e.g., IDE, 1983, Lincoln, et al., 1990). These studies examine how work practices predict employees' attitudes. But they are often based on samples of convenience, leading to concerns about how well the results represent the true incidence of work practices in the economy. In addition, the fact that the establishments covered produce many kinds of products and services precludes common hard measures of outcomes such as productivity.

Three of the studies reported in this symposium (Kelley, Dunlop and Weil, and Berg, et al.) represent a third line of research which focuses on the effects of workplace practice on

organizational performance in specific industries. This focus makes it possible to make more precise measurements of performance, work practices, and control variables. In addition, within-industry studies automatically control for factors that differ between industries. This approach also enriches the quantitative analyses with the authors' detailed knowledge of each industry's history, technology, industrial relations, and product market.

Methodological Issues

What kind of studies would provide the greatest confidence about the direction and magnitude of the performance effects of innovative work practices? Case studies may provide rich insights, but one can never be sure if case study results generalize. While case studies can be very useful for suggesting hypotheses, one must ultimately study larger samples to test those hypotheses. To go beyond case study descriptions, an ideal study would have high internal validity, meaning that explanations (other than the ones being investigated) for an observed correlation between performance and work practices can be ruled out. The ideal study would also have high external validity, that is its results could be generalized to infer the likely impacts of new work practice were they introduced outside the sample studied.

The ideal design for ensuring high internal validity is an experimental design with random assignment of the innovative work practices. In such a design the best estimate of the effect of high involvement work practices is provided by the following regression (where "innovative work practices" is a dummy variable equal to one if an organization has innovative work practices):

$$\text{Organizational Performance}_i = a + b \text{ Innovative Work Practices}_i + \text{Residual}_i$$

The goal of random assignment is to ensure that (on average) the treatment and control groups do not differ in terms of other organizational characteristics affecting performance such as management or worker quality. Thus, with random assignment, the mean difference in performance between the two groups (the parameter b in the equation) will on average reflect only the impacts of the innovative work practices in question.

The external validity of an experiment depends on how closely the research sites resemble the populations we might like to understand. If an experiment is based college students formed into teams that work together for a single hour we may be skeptical about whether the findings would apply to long-term employees of real businesses. Thus, we would have greater confidence in the external validity of a design that involved the random assignment of a high performance intervention to half of a population of workplaces in a single industry or single firm and left the other half unaffected.

No large-scale studies have used this design and it may be impossible to achieve. Our purpose is not to discourage research in the area, but to lay out this ideal type and use it as a framework for evaluating the existing research. How close have existing studies come to a true experiment, and what are the directions for future research in this area?

Omitted variables. The key benefit of an experiment with random assignment is that the innovative work practices are typically uncorrelated with other worker and organizational characteristics that presumably affect performance. The non-experimental studies in this volume and elsewhere lack random assignment and attempt to control for this possibility by measuring and statistically controlling for variables that affect performance and are correlated with whether or not organizations introduce innovative workplace practices.

Organizations that adopt innovative work practices may have "better quality" workers, and/or those with "higher quality" management teams may both introduce new workplace practices and pursue more imaginative marketing, finance, and R & D strategies. So to what extent is improved performance due to work practices alone? Self-selection, which occurs when organizations that introduce workplace innovations are more likely to enjoy other good practices as well, implies the estimated effect of innovative workplace practices will be greater than the true effect.

The opposite form of self-selection processes predicts that it is the less successful organizations which are the more likely to innovate. Firms may adopt workplace innovations only because they are in trouble. By contrast, a highly successful organization may develop "competency traps" and be unwilling to depart significantly from existing policies which the

organization believes are responsible for its success (March, 1988). So, when troubled companies are most likely to experiment with new practices, even successful programs may appear to be failures. Put in technical terms, these forms of self-selection imply the non-experimental estimates could be biased downward relative to the true effect.

Selection biases may be especially problematic when comparing multiple establishments or work units within a single company (e.g., Katz, et al., 1983). Some innovations may be introduced in operations that are the poorest performers in order to avoid shutdown or to gain top management support for new investment. Other early innovators may be staffed by the best, most progressive managers. In either event, the estimates of the effects of the new practices will be biased.

If the omitted variables are relatively stable over the study period, then the use of longitudinal data that examines whether changes in work practices predict changes in performance (Huselid and Becker) can control for omitted factors such as workforce or management quality. At the same time, these gains may be offset by greater measurement error of innovative work practices. If the omitted variables are not stable, then the only remedy is to must identify them from theory, measure them, and attempt control for them statistically in the analysis.

If the same diffusion process applies across industries and firms, then even the average estimate of the performance effect of innovative work practices averaging across a number of industry studies will be biased. Alternatively, if in some industries high performing firms implement innovative work practices and in other industries low performing firms are early implementors, then the average effect from the studies may not be seriously biased. This observation has two implications for future research. First, in order to better understand the effect of innovative work practices on performance using non-experimental studies, we need more studies like Pil and MacDuffie and Dunlop and Weil that examine the diffusion of innovative work practices and try to identify the links between past performance and the decision to pursue an innovative work practices strategy. Ideally, this would include both quantitative studies of diffusion and rich case studies that, for example, might contrast an early innovator in an industry and follow this up with a study of a later innovator.

Studying the diffusion process also involves studying the survival of innovative work practices. When firms abandon innovative work practices does it indicate poor fit with other firm policies (e.g., Dunlop and Weil), poor implementation, or a poorly chosen bundle of work practices? In the absence of experimental control, it is critical that we study the implementation process to improve our understanding of the correlation between innovative work practices and the many variables that affect organizational performance.

Response bias. Even if an appropriate sample is selected, if survey respondents and non-respondents differ in important ways, the results may be biased. Such response bias can induce a correlation between performance and variables affecting performance that are unobserved by the researcher (the residual in our equation) even where there is no correlation in the population.

Researchers usually rely on data from establishments or firms that voluntarily agree to be observed or agree to complete a phone or mail survey. The need for cooperation introduces the possibility that firms that may enjoy above-average success with their workplace innovations will be more likely to participate than those less successful. The latter may prefer to remain silent. Thus the study may overstate program gains.

Longitudinal studies require ongoing organizational participation, something which many organizations are unwilling to provide. Huselid and Becker's study is based on 218 firms (out of about 3500) that gave usable responses in both waves of their study. Longitudinal studies must not only worry about whether the respondents in the initial wave are a random sample of the population, but also must be concerned that attrition between waves may be related to performance. This is almost certain to be a problem because failing firms by definition do not respond to the second wave.

The best solution is a large random sample with a very high response rate. To date, U.S. researchers have not been able to combine these desirable features. (British longitudinal surveys, by contrast, have response rates of over 80 percent [Millward and Stevens, 1986]). Ultimately we need a better understanding of why organizations agree to respond to workplace practice surveys, and the ability to track the history of non-responding organizations as well as respondents.

The unit of observation. In the ideal field experiment, the innovative work practices are applied to all workers in one randomly selected group of organizations and not to another. Then the performance of workplaces who received the intervention is then compared to those who did not. An experimentalist would not include in the measure of performance for the treatment group the performance of workplaces that were not subject to the treatment. If not all the workers in the treatment group actually worked in workplaces with innovative practices, the estimated effect of the new work practices would only be less than the true effect. This bias suggests estimates based on corporate-level performance measures (Huselid and Becker) are likely to be lower bound estimates of the effect of innovative work practices policies.

To see the problem, consider the example of a well-run employee involvement program that raises productivity by 10% in those workplace in which the program is introduced; however, as is the case with most companies studied in this symposium, only 20% or so of the employees are involved. Assume further that the kinds of measurement error discussed below reduces the estimated impact by one-half, as is likely with such difficult-to-measure constructs as employee involvement. Thus, it would seem, employee involvement increases productivity by only one percent. If some of this productivity gain is split between workers and shareholders, the impact of these innovations on profits and stockholder will be less than one percent.

It is important to study the effects of innovative work practices on financial performance because investors and managers focus on these measures. However, our example shows that the lack of a sizable effect on financial outcomes is likely even when a fairly effective innovation affects only a small group of workers while performance is measured over a broader sample of workers. In particular, we should be reluctant to accept the null hypothesis that the work practices have no effect when the unit of observation for the performance measure differs substantially from the treatment unit.

Measurement Issues. In an experiment the researcher has a well defined treatment and typically performs a manipulation check to ensure the implementation of the treatment was effective. Also, because the experimental researcher controls who does and does not receive the treatment, there is typically no measurement error caused by incorrectly measuring whether a

subject was either in the treatment or control group. Non-experimental researchers evaluating innovative work practices lack the luxury of experimental application of the intervention, leading to a number of different sources of measurement error.

Many of the constructs central to innovative work practices practice are based on subjective judgments. For example, a "semi-autonomous work team" may be a totally autonomous group without outside direction, or it may be a traditional workgroup with a supervisor who held a single team meeting six months ago.

While careful construction of the survey and multiple measures of the same construct can go a long way in alleviating this problem, it is likely to remain a serious source of error. Eaton (1994)n for example, found that managers and union leaders often disagree about whether or not a specific program was actually in existence in an establishment. Moreover, as Huselid and Becker show, the effect of this kind of error is magnified when using longitudinal data to examine changes in work practices -- it is often more precise to measure whether something exists than to measure it twice (each time with error) and then identify how much it has changed.

Many studies measure innovative work practices using only one respondent per firm or establishment, implying that any idiosyncratic opinions or interpretations of the questions can distort the results. Commonly, the respondent is often a top-level manager who may have limited knowledge of what is happening at the workplace. Responses of single corporate-level executives of large companies (as in Huselid and Becker) may be particularly noisy and potentially biased indicators of actual workplace practices.

If the measurement error is random relative to the true value then it biases the estimated effect of innovative work practices on performance towards zero. There are some strategies for dealing with this simple type of measurement error that have not been used in this field. For example, the biasing effect of purely random measurement error could be overcome with just two respondents from each establishment using an instrumental variable techniques as in Ashenfelter and Krueger (1994).

Unfortunately, measurement errors may be systematically related to the true level of performance or of innovative work practices. Some respondents may exaggerate their own

success with the innovative work practices programs while others will fail to report unsuccessful efforts at implementing innovative work practices. Such errors may be reduced if there is more than respondent per organization or if the researcher conducts site visits and interviews with multiple respondents at different levels and in different roles within the organizations.

Four studies in this symposium address the measurement issues by studying multiple plants within single industries, and by obtaining rich information on work practices from knowledgeable respondents. Kelley surveyed the managers directly responsible for the activities being measured. Berg, et al., and MacDuffie and Pil visited each plant in their samples. Dunlop and Weil conducted extensive interviews with experienced industry practitioners prior to designing their survey.

The intra-industry studies in this volume that examine performance provide relatively "hard" data (such as the number hours required to assemble a car) and represent a significant improvement over potentially biased self-reports of the effectiveness of innovations.

Unfortunately, it is expensive to make plant visits or to obtain multiple respondents in reach plant. Thus, researchers who make intensive surveys of individual plants typically settle for smaller sample sizes. The smaller sample size, in turn, makes it more difficult to precisely estimate the effects of work practices on performance and increases the chances of concluding that a given practice has no effect even when it does. Moreover, if some practices are more effective when used in combination, it is difficult to detect these interaction effects in small samples. Finally, it is unclear how well results from intra-industry studies generalize to other settings

While it is more difficult to control for the many sources of variation in performance of heterogeneous firms in cross-industry samples (leading to greater concern with omitted variable biases), studies using these samples can examine important firm-level outcomes such as profits and stock market data (Huselid and Becker).

Identifying "Bundles". In an ideal experiment, theory would inform us of the theoretically interesting sets of workplace practices. The researcher would then assign different sets of work practices to different workplaces, and we could easily identify which bundles were effective. In

doing so, we could also identify which work practices were substitutes (for example, when only one of a pair is needed), and which were complements. In non-experimental research, it is difficult to identify which workplaces have introduced a theoretically sound bundle of practices.

One problem is that some practices are substitutes. For example, either employee stock ownership or profit-sharing may create employee identification with the employers. Other practices may be complements; as noted above, some work practices may be more effective when introduced as a bundle. For example, it may be far more effective than to both train front-line employees in problem-solving and to permit them to solve more problems than it is to make either change alone.

Because bundles are hard to measure, it is difficult to identify which organizations have "the" non-experimental treatment of being innovative, and which have not. In apparel, the change from the assembly-line bundle system to the team-based module system is relatively discrete, facilitating identification of innovative workplaces (Berg, et al.; Dunlop and Weil).

Unfortunately, even here not all module systems involve cross-training, implying incomplete implementation of the new system (Dunlop and Weil). In other settings, the researcher usually lumps together a number of specific work practices into a smaller number of indicators of work systems. Some researchers rely on theory to identify their indices of workplace practices, for example, ad hoc indices [Pil and MacDuffie] or confirmatory factor analysis [Kelley].

Unfortunately, these methods implicitly assume work practices are substitutes, even though theory suggests complementarities can be important. Other methods permit the data to identify workplaces with different bundles of practices (for example, cluster analysis).

No matter how bundles are measured, the method of identifying workplaces as more and less innovative is always subject to some error. The most convincing results utilize multiple methods and test whether different procedures yield similar groupings of work practices, and predict similar performance results (Ichniowski, et al., 1995).

Longitudinal versus cross-sectional designs. With an experiment that has random assignment, one can estimate the effect of innovative work practices on organizational performance with a single cross section of data. In non-experimental studies, cross-sectional data

make it very difficult to rule out the possibility that omitted variables affect the result. Thus as Huselid and Becker argue, longitudinal studies are often preferable. We are pleased to note that three of the studies (Dunlop and Weil, Huselid and Becker, and Pil and MacDuffie) analyze multiple periods of data.

Longitudinal data raise other important design issues. Huselid and Becker show how measurement error can increase when looking at changes in work practices and performance. Another problem: how long should the treatment be applied? And when should the performance measure be taken? If the theory predicts that the innovative work-practices "treatment" is a complex set of practices designed to influence employees' skills, motivation and organizational commitment, then the complexity of workers' responses may also require that considerable time pass before the treatment alters behavior and performance is measured. This time lag may be even longer if workplace changes are introduced only slowly. As Pil and MacDuffie point out, a plant may still be in transition when the measurement is made and things may get worse before they get better. Moreover, in many cases productivity improvements lead to layoffs, not higher output; thus, innovations that depend on employee initiative may carry the seeds of their own destruction (Kofman, Reppening, and Sterman, 1995).

The Huselid-Becker results suggest the lagged effect of workplace changes may be significant, but they cannot say how long the lag might be because they have only two periods of data. The Dunlop and Weil and the Sterman, Reppening and Kofman (forthcoming) studies suggest the decision to implement innovative work practices may be "bundled" with other organizational changes that may have their own performance effects and these other changes may cause or have feedback effects on the original innovations.

These complications do not mean we should not collect longitudinal data; it simply means we need to collect better measures of innovative work practices policies and information on other organizational changes that may affect performance and are correlated with innovative work practices policies.

How research design affects confidence in the results. In short, it is difficult to measure the true effect of work practices such as employee involvement on productivity. The

measurement problems can lead researchers to find no relationship when there truly is one, or can lead them to believe there is a relationship when there is none. Unfortunately, we cannot even be sure of the sign of the bias -- that is, whether estimated results will be unrealistically positive or negative. Omitted variables, non-random samples and measurement error are all potential sources of bias that affect both the internal and external validity of the non-experimental studies in this area.

Evidence as to Performance

The net result of the problems described above is that no single study is likely to be completely convincing. The key to credible results is creating a collage of studies which use different designs with their own particular strengths and limitations.

The studies in this issue focus on different levels of analysis ranging from single production lines, to the establishment, the corporation, and the economy as a whole. They also examine many different performance measures including employee attitudes, productivity, quality, profitability and stock prices. They focus on a wide range of work practices. They employ both cross-sectional and longitudinal designs. Moreover, the studies in this issue are only a subset of a larger and growing body of research on these topics that contain equally diverse samples, measures and designs. Taken together, the studies provide a check on the results of any single study and those results which many studies support are all the more convincing.

In this section, we review several broad themes which emerge from this diverse body of research, considering in turn case studies, single industry studies, and studies using national cross-industry samples.

Case Studies

Here we examine several methods of learning from case studies: longitudinal studies of manufacturing plants before and after changes to a more participatory work environment; cross-

sectional case studies of work groups operating under different sets of work practices within single companies; and a meta-analysis of over 100 case studies.

Longitudinal case study: NUMMI. The New United Motors Manufacturing Inc. (NUMMI) assembly plant in Fremont, California represents perhaps the most visible and highly publicized transformation in work practices, labor-management relations, and economic performance during the 1980's. NUMMI provides an early example of case with documented changes in hard measures of performance after the adoption of new work practices (Krafcik, 1988; Shimada and MacDuffie, 1987; Womack, Jones, and Roos, 1991; Adler, 1992; Adler et al., 1995; Wilms, 1995).

NUMMI is a joint venture between GM and Toyota. In 1982 these companies and the United Auto Workers (UAW) signed an agreement to reopen a closed GM assembly plant in Fremont, California. The GM Fremont plant had a traditional work system and labor-management relationship with high grievance and absenteeism rates. Toyota negotiated a new agreement with the UAW which allowed it to implement the Toyota production system that emphasized just-in-time inventories, statistical quality control, and an integrated approach to technology and human resource management (Shimada and MacDuffie, 1987).

Eight-five percent of the employees hired for the new plant came from the laid off GM workforce. They received training in the Toyota production system and in problem solving and teamwork processes. Work was organized into teams rather than individual job classifications, traditional work rules were eliminated, a single wage rate was introduced for unskilled hourly workers, and a high priority was given to communications with workers and union leaders.

While the Fremont plant had been one of GM's worst performing plants with very low levels of productivity (48.5 hours per vehicle), NUMMI achieved the highest productivity and quality performance of any North American assembly plant within two years of its startup (19.6 hours per vehicle and 69 defects per 100 vehicles). Though work practices changed dramatically after the new joint venture agreement, Toyota introduced little new technology in the reopened facility that would account for these dramatic performance improvements. Comparisons to other more automated plants in the GM system showed that in 1987 GM's most automated facility

(approximately 40 percent more automated than NUMMI) required 33.7 hours per vehicle with 137.4 defects per vehicle (Krafcik, 1989). Follow-up studies (Adler et al, 1995) reported that NUMMI's productivity and quality continued to improve marginally over time and remained among the best of North American auto assembly plants (Womack, Jones, and Roos, 1991). NUMMI and the UAW have since renegotiated their labor agreement several times. Union leadership has changed with considerable internal union debate over aspects of the NUMMI system (Parker and Slaughter, 1988), however, the basic features of the work system and related human resource practices remain in place.

Longitudinal case study: a paper mill. Ichniowski (1992) documents the change from traditional work practices to a set of innovative HRM practices at a unionized U.S. paper mill. Previously, the mill had traditional work practices. Jobs were defined narrowly -- ninety-four job classifications covered some 160 employees on a given shift. Wage rates were attached to jobs that were allocated according to employees' seniority. Labor-management communication was channeled through a traditional grievance procedure with long backlogs of cases.

In 1983, during contract negotiations that involved a bitter, three-month strike, management implemented sweeping work practice changes calling it the "Team Concept." Job classifications were reduced from 96 job titles to 4 work "clusters." Workers received extensive training to make them proficient in their new broadened tasks. Old pay rates were eliminated and all workers received the highest of all the old pay rates now in that cluster. Employment security was guaranteed to all mill workers. Precedents of old arbitration cases were eliminated. The grievance procedure was maintained, but was also supplemented by monthly "listening sessions" between work crews and top mill management. In short, under Team Concept, the mill adopted a broad set of work practice innovations in the areas of job design, compensation and rewards, communications, and employment security.

Many effects of the change were predictable. Employment levels remained steady during the three year term of the agreement in keeping with the employment security pledge. Total labor costs increased 40%, due to the provision which paid all employees in the new job clusters the highest pay of any of the old jobs now in the clusters. However, despite becoming a more

costly mill under Team Concept, it became more profitable. First, productivity increased. After maintaining steady production levels in 1984, production increased by 5% over the 1983 pre-Team Concept levels. The extra production and sales revenue more than offset the higher labor costs. Second, non-labor costs also declined substantially. As a result, mill profitability more than tripled between 1984 and 1985, from \$.89 million to \$2.75 million.

There were many specific causes for the production increases, savings in non-labor costs, and associated increases in profitability, but main one was workers' suggestions for improving operations that they had never before offered. As examples, downtime was dramatically reduced. One of the two annual shutdowns for major maintenance, the standard practice for the industry, was eliminated. Worker-generated suggestions and modifications identified ways to reduce costs and to increase the speed and efficiency of the machinery. Or, as one manager described it, "the workers just made the machines run faster."

Thus the Team Concept helped transform a marginally profitable paper mill with an adversarial labor relations environment into one of the most productive mills in North America, manned by the highest paid paper workers and operating at levels of profitability never previously attained. Furthermore, the success of the continuous improvement process achieved by 1985 under the Team Concept contract was not short-lived. Total mill production continued to increase and reached approximately 800,000 tons by 1990 -- an additional increase of over 20% from the output levels in 1985.

Indicators of the quality of the working environment also improved. Grievance filing rates dropped from 80 per month in 1983 to 4 per month in 1984. Accident rates fell from 4.0 per month in 1983 to 1.6 per month by 1985. The rate of absenteeism declined by one-half from 2.1 percent in 1983 to 1.0 percent in 1985. By 1990, labor and management had peacefully renegotiated the original Team Concept labor agreement of 1983 three more times with substantial pay increases for mill employees.

Comparative case studies: apparel. Berg, Appelbaum, Bailey and Kalleberg (in this issue) made a cross-sectional comparison of the performance of two apparel plants making an identical garment under two very different methods of work organization--one using the

industry's traditional "bundle system" and the other the team-oriented "modular production system."

Module work enjoyed a 30% advantage in overall production costs over bundle work, attributable to large savings in warehousing, materials, and direct labor costs. Warehousing and materials cost advantages are expected, given the module system's emphasis on quick turnaround of small orders with minimal work-in-progress inventories. The lower labor costs for modules are more surprising because bundle manufacturing has the advantage of specialization. Interviews suggest that module operators spend much less time opening and closing work-in-progress bundles, sorting through bundles for necessary pieces, and setting up materials for any given work task.

The difference between bundle production's specialized jobs and module production's multi-skilled work teams is however only a small part of a larger set of systematic differences in work practices. Relative to the more traditional bundle system, workers in the module system receive more training in problem-solving skills and other. They are more likely to receive profit sharing and to be covered by a multi-attribute gainsharing plan that covers more dimensions of performance than the output-based piece-rate pay.

Work groups at Xerox. Cutcher-Gershenfeld (1991) studies the effects of changes in workplace practices at manufacturing facilities of the Xerox Corporation. In 1981, Xerox and the Amalgamated Clothing and Textile Workers Union (ACTWU) jointly implemented an employee participation and work redesign effort. What started as a narrow quality circle program gradually evolved into changes in many work practices including self-managing work teams, special problem solving task forces, increased flexibility, decentralized decision-making, reductions in status differences among workers and supervisors, and methods for resolving grievances informally.

Three Xerox plants that were transformed in this way were compared with plants that retained traditional features. Transformed units exhibited significantly higher productivity and lower scrap, costs, and direct labor hours than traditional units. Xerox and the ACTWU have

now sustained their commitments to the new work practices and the new labor-management relationship since its inception in the early 1980's.

Work groups in a telecommunications company. Following deregulation and the break-up of the old AT&T Bell System the telecommunications industry has experienced rapid technological change, substantial product innovation, downsizing, and increased competition. Meanwhile many telecommunications firms have introduced workplace innovations. Examining this trend, Batt (1995) compared work groups operating under different work practices in a regional telecommunications company.

Employees in two different business units of this company were involved. One unit, network service, performs repair and field service operations. The other, customer service, sells new services and responds to customer phone inquiries. During the period of the survey the units worked under three different types of practices. Some work groups retained their traditional work arrangements. Other groups engaged in total quality improvement programs; these groups met periodically to discuss workplace problems, but did so outside of their normal jobs. A final set of work groups were transformed into self-managed work teams. The performance of work groups under these three types of arrangements were compared.

Compared to traditional work arrangements the quality program made little difference in performance while self-managed teams made a lot. In network services, the primary effect of self-managed teams was to reduce the number and costs of middle management. In customer services, self-managed teams achieved sales that were some twenty percent higher than the sales of traditionally organized work groups. Both sets of self-managed teams reported higher levels of quality and quality improvement.

Apparently the quality program had little impact on workers' attitudes. In contrast, employees in self-managed teams reported significantly higher levels of autonomy, learning, and cooperation within their groups compared to traditionally organized groups. Ninety percent of those in self-managed teams preferred their new work arrangements. Seventy-five percent of those in traditional arrangements expressed a desire to work in teams.

Meta-analysis of individual case studies. The case studies just reviewed strongly suggests that a wide-ranging set of innovative HRM practices supports superior economic performance a limited set of industries and companies. Still, a broader set of case studies would help provide evidence on whether this pattern of findings apply more generally in American industry.

Macy and Izumi (1993) report on an meta-analysis of published and unpublished case studies on organizational change initiatives that were conducted between 1961 and 1991. These authors consider a broad range of organizational policies including thirty-one related to human resources (e.g., fewer job classifications, multi-skilling, different types of work teams, features of compensation systems, and communication procedures), as well as a considerable number of possible outcome measures including fourteen indicators of economic performance (e.g., output and productivity measures, quality indicators and cost indicators).

Several obvious caveats in interpreting patterns from this overview of case-based research must be kept in mind. First, outcome measures differ across studies and so are not comparable. Second, for researchers to gain access to outcome data, there is a strong suspicion that successful organizational changes will be overrepresented (Macy and Izumi, 1993, p. 283). Despite the study's limitations, it offers evidence on the experiences of a large number of North American businesses with workplace innovations over the last two decades.

Overall, over three-fourths of the case studies that reported changes in economic outcomes also reported that these were positive. Of particular interest, the number of organizational changes in policies and practices is positively correlated with increased economic performance. No similar correlation was observed with the number of policy changes and worker attitudes (e.g., satisfaction) or behaviors (e.g., turnover). Again, the pattern appears to be that the largest performance changes occur when businesses make more sweeping changes in sets of work practices and other related organizational policies.

Intra-Industry Studies

We next review results from studies using broader samples of businesses within four narrowly defined industries -- integrated steel making, automobile assembly, apparel

manufacture, and metal working. These studies are noteworthy for their attempts to investigate comprehensive samples of specific types of businesses, for their attention to constructing convincing industry-specific measures of work practices and performance, and for incorporating insights from extensive field research to understand the nature of how businesses in these industries compete.

Intra-industry study: steel mills. Ichniowski, et al., (1995) studied the relationship between work practice innovations and economic performance in a sample of steel finishing lines. After conducting on-site investigations in nearly all U.S. production lines of this kind, they assembled detailed longitudinal data on multiple measures of performance on the production technology and work practices at these sites. Three main conclusions emerged from their research.

First, work practice innovations are highly correlated. Most mills have one of four basic combinations of the work practices. A "traditional" system features narrow job classifications, no work teams, communication confined largely to the grievance procedure, training only through on-the-job learning, and traditional steel industry incentive pay based on tons of steel produced. The "innovative" system is the antithesis of the traditional system: it features extensive screening and orientation at time of hire, broadly defined jobs and problem-solving teams, extensive on- and off-site training in production skills and problem-solving processes, multi-attribute gainsharing-type compensation schemes, employment security policies, and extensive labor-management communication including sharing of financial information. Between these extremes are two intermediate cases -- one with work practice innovations only in the areas of teams and labor-management communications and a second with a more extensive set of innovations.

Second, the different work systems have large effects on productivity and quality outcomes. According to both longitudinal comparisons of production lines that switch their systems of work practices and cross-section comparisons of lines with different HRM systems, those lines with the innovative work system always have the highest levels of productivity and quality of output, and traditional systems the lowest.

Third, in contrast to the large effects that different *systems* of work practices have on economic performance, changes in individual work practices have no effect on performance. In sum, the study shows that the adoption of a coherent and integrated system of innovative practices, including extensive recruiting and careful selection, flexible job definitions and problem-solving teams, gainsharing type compensation plans, employment security and extensive labor-management communication, substantially improves productivity and quality outcomes. The adoption of individual work practice innovations has no effect on productivity.

Based in his study of 30 U.S. steel minimills Arthur (1994) categorizes human resource and workplace environments into "control" and "commitment" systems (a distinction similar to Ichniowski, et al's, traditional and innovative systems). Like Ichniowski, et al., Arthur finds that mills with a system of more innovative workplace practices enjoy higher productivity and quality than do mills employing more traditional practices.

Intra-industry study: auto assembly plants. MacDuffie (1995) reports on the relationship between various work practices and productivity and quality measures in a sample of 57 auto assembly plants. This sample represents a large fraction of non-luxury car production, and includes plants from North America, Japan, Europe, Australia, Korea, Taiwan, Mexico, and Brazil. Detailed measures of productivity and quality that adjust for production and assembly differences were developed and related to two work practice indices -- one based on several variables measuring the design of work (e.g., breadth of job definition, extent of work involvement and team activities) and a second index of a broader range of human resource practices (e.g., pay-for-performance compensation and high levels of training).

In this industry, plants that couple various innovative work practices with a set of production practices representative of "lean manufacturing" (e.g., low buffers and low work-in-process inventories between stages of production) enjoy the highest levels of economic performance. For example, productivity is highest when plants score highest on a combination of the work organization index, the human resource policy index, and the production policies index. In auto assembly plants, systems of innovative work practices are again important determinants

of superior performance, but here these policies must be coupled with production methods that are most compatible with this form of work organization.

Intra-industry study: apparel-making. Dunlop and Weil (in this issue) investigate the relationship between work practices and performance in a sample of thirty-five apparel-making business units producing a limited set of garments categories. Like the Berg et al. study of apparel makers, Dunlop and Weil find that module production and bundle production have very different work practices. Module workers perform more tasks and receive more training to accomplish these tasks. Also they are more likely to be covered by multi-attribute group incentives instead of by piece-rates.

Dunlop and Weil show that module production and its particular set of team-oriented work practices go together with more modern product distribution methods, such as direct computer connections between manufacturer and retailer and product bar coding to track shipments and retail sales. Plants that were early adopters of module production's new HRM practices without changing their information processing and distribution procedures often abandoned the new work practices. In contrast, plants that implemented the new HRM practices together with the new distribution methods continue to operate under the new practices and appear to enjoy higher profitability.

Industry study: metal working and machining plants. Kelley (in this volume) investigated the effects of problem-solving teams and related HRM practices on performance in a sample of plants in twenty-one industries engaged in various metalworking and machining operations. This study identifies one set of plants that rely on labor-management committees, autonomous work groups, and contingent pay plans like employee stock ownership plans, and contrasts the performance of these plants with others that have more traditional union-management relationships and work rules. Plants with more participative work arrangements typically exhibit higher levels of performance. The main exception to this pattern occurs among single-plant firms where the participative arrangements are not associated with superior performance.

National Cross-Industry Studies. While the intra-industry studies examine a much larger number of establishments and businesses than do the case studies, the evidence in these studies is

confined to four manufacturing industries. Do the empirical patterns showing higher levels of performance for bundles of innovative practices and lower levels of performance for more traditional sets of work practices extend more broadly to other sectors of the economy? Huselid (1995) provides evidence based on a large sample of U.S. corporations in many industries. Performance data come from the 1991 Compact Disclosure data base. Of 3,452 firms across all industries in this data base, 28% or 968 firms responded to Huselid's survey.

Huselid constructs two indices of work practices -- one labeled "skills and work structures" (composed of elements such as job analysis, attitude surveys, participation programs, skills training, and communication and dispute resolution procedures), and another called a "motivation" index (constructed from responses about performance appraisals and merit-based pay plans). Higher levels of each index generally correspond to more work practice "innovations" as defined at the outset of this study. In cross-section analyses, the employee motivation index is significantly correlated with firm productivity, while both the skills and structures index and the motivation index have significant effects on firms' stock market valuation.

Huselid's findings are consistent with the results of an earlier survey-based study of businesses in diverse industry groups. Ichniowski (1990) surveys COMPUSTAT II business lines for their work practices and relates these work practices to productivity and stock market performance indicators available from the public sources. While this survey yielded a considerably smaller sample of businesses than does the Huselid study, the empirical patterns are similar: HRM practices are highly correlated and businesses that adopt a full complement of innovative practices including extensive labor-management communication, merit-based rewards, training, and flexible job design have higher levels of productivity and stock market value.

In short, the empirical evidence from case studies, samples of plants within specific industries, and broad national samples of firms in different industries tell a consistent story:

Conclusion 1: Innovative human resource management practices can improve business productivity, primarily through the use of systems of related work practices designed to enhance

worker participation and flexibility in the design of work and decentralization of managerial tasks and responsibilities.

There are no one or two "magic bullets" that are *the* work practices that will stimulate worker and business performance. Work teams or quality circles alone are not enough. Rather, whole systems need to be changed.

How Big an Impact?

By how much do work-system changes affect performance? Is there impact large enough to be economically important? We now have some evidence.

Huselid's (1995) national, cross-industry study finds that annual sales per employee are as much as \$100,000 higher in businesses with the "best" work practices than they are in firms with the "worst". (This calculation assumes the best and worst work practices differ by four standard deviations of Huselid's index.) This considerable figure is more than half the average value of this productivity measure in these businesses. Differences in work practices affect profits by as much as \$15,000 per employee per year higher with differences in stock market measures of performance of about equal magnitude.

Huselid and Becker report results from a longitudinal analysis using a second time period of data for Huselid's original sample. Estimated performance effects using these panel data are smaller in magnitude than the cross-sectional estimates. They argue that measurement error in the survey data on HRM practices is a likely cause for the reduced estimates. Their corrections for this measurement error bias suggest that the magnitude of the actual effects of the HRM measures may be closer to cross-section estimates.

While these figures may seem implausibly large, research on samples of very similar businesses where measures of performance and technology are more precise again show very large effects. In their comparison of plants with one very specific steel-making production process, Ichniowski et al, (1995) estimate that production lines with a full complement of innovative HRM practices are about 7 percent more productive than those with more traditional practices. This productivity difference corresponds to a difference in annual revenues of some

\$2.5 million for this single production area. Improvements in quality of steel production attributable to the new work practices suggest that the revenue effects are even larger than the productivity effects alone imply. Revenue effects of this magnitude dwarf any reasonable estimates of the direct costs of the work practices themselves.

Case study evidence is consistent with these conclusions. After adopting the Team Concept the paper mill increased productivity by some five percent and tripled profits. The case study of apparel plants found an overall cost advantage of some 30% for module production over bundle production for an identical garment. Batt's (1995) case study of the telecommunications operations found that the increase in annual sales revenue associated with self-managed groups in customer service units translated into more than \$10,000 per employee, and in network operations cost savings due to self-managed teams would exceed \$200 million per year for the whole division.

Adopting workplace innovations individually. Some studies that investigate the performance effects of workplace innovations estimate much smaller effects of the innovations (see Levine and Tyson, 1990), but these studies focus on individual work practices, such as work teams or quality circles. Without data on sets of work practice innovations, these studies tell us little about whether systems of workplace innovations would have larger effects. Two studies provide evidence on this issue. Katz, Kochan, and Keefe (1987) find that plants that collapsed traditional job classifications into teams without changing other aspects of the labor-management relationship or environment performed worse than traditional systems. Ichniowski, et al, (1995) include a direct test of relative performance effects of individual workplace innovations and new work systems. In contrast to their finding of large performance effects of new overall work systems reviewed above, they find that the adoption of individual innovative work practices does not improve productivity and sometimes is associated with its decline.

The evidence from very different data sources points to a second consistent theme about the magnitude of performance effects due to workplace innovations:

Conclusion 2: *New systems of participatory work practices have large, economically important effects on the performance of the businesses which adopt the new practices.*

Extent of Adoption

While the research shows that work practice innovations have large payoffs, some businesses have adopted these productivity enhancing practices and others have not. This pattern raises at least two important questions. First, how many businesses have systems of innovative, productivity-enhancing work practices relative to those without them? Second, why have more businesses not adopted them?

National cross-industry survey data. As to first question, Osterman (1994) provides the most comprehensive information. His study reports on the adoption of various work practice innovations among a sample of some 800 U.S. establishments, was designed to be representative of the entire population of private sector U.S. business establishments with over 50 employees. Emerging from this survey are two broad conclusions as to the extent to which of various innovations have been adopted. First, a clear majority of U.S. business establishments have adopted at least one work practice innovation. Workplace flexibility, defined as 50% of employees participating in teams, quality circles or job rotation, is present in 62% of U.S. establishments. Contingent pay, defined as the presence of gainsharing, pay-for-skills, or profit sharing, is present in 65%. Training, defined by more than 20% of employees in cross-training or off-site training, is present in 81%. And employment security pledges are in effect in 40% of these business establishments.

At the same time, U.S. establishments rarely adopt bundles of practices of the kind that the evidence just presented appears to be responsible for improved economic performance. Only 16% of U.S. businesses have at least one innovative practice in each of the four major HRM policy areas: flexible job design, worker training, pay-for-performance compensation, and employment security (Osterman, personal correspondence. Lawler, et al, 1995, report similar results for very large U.S. employers.) In short, while individual work practice innovations are quite common, systems of innovative work practices are relatively exceptional.

Adoption in specific industries. This pattern in Osterman's national survey is consistent with findings from broad samples of establishments in steel, apparel, and automobile assembly

industries. In steel, only 16.7% of the sample of steel production units have no innovative practices at all in the areas work teams, training, selective screening policies, gainsharing-type incentive pay plans, job flexibility, employment security, or regular labor-management information sharing (Ichniowski and Shaw, 1995). While the vast majority of steel making facilities have therefore adopted some new work practices in at least one of these areas, only 11% of these production units had the full system of innovative work practices that is shown to lead to the highest levels of productivity and quality. Put another way, although innovations are spreading and most steel businesses have some innovative work practices, very few have a full complement. In apparel manufacturing, the innovative modular system, which has better performance along a number of dimensions, is growing in importance. Nevertheless, it accounts for only 9.8% of apparel volume shipped (Dunlop and Weil, 1995). Similarly in automobile manufacturing, innovation is spreading and many plants have some experience with some innovative work practices, but only about one fourth have a full system (MacDuffie, 1995) .

The answer to the question concerning how extensively work practice innovations have been adopted by U.S. businesses therefore depends on the definition of "innovations." In particular:

Conclusion 3: *A majority of contemporary U.S. businesses now have adopted some forms of innovative work practices aimed at enhancing employee participation such as work teams, contingent pay-for-performance compensation, or flexible assignment of multi-skilled employees. However, only a small percentage of businesses have adopted a full system of innovative work practices comprised of an extensive set of these work practice innovations.*

The second part of this conclusion is particularly important since research on work practice innovations indicates that businesses must adopt a comprehensive system of these innovative work practices to achieve the highest levels of productivity and performance.

Impediments to Broader Diffusion

If systems of innovative work practices stimulate productivity, quality, and other dimensions of business performance, why haven't they diffused more widely through the economy? Why have the experiences of many U.S. businesses with limited forms of workplace innovation not grown into more comprehensive approaches? Unfortunately, we have little hard evidence or good theory to provide a thorough answer to these critical questions. Nevertheless, this section suggests several possible explanations, viewing them as hypotheses in need of further testing.

Limited performance gains for some businesses. One possible reason for the diffusion is that innovative work practices may lead to the higher levels of performance only in some industries or firms. The evidence reviewed above is largely confined to a subset of manufacturing industries. New work systems that include participatory team structures, extensive training, and employment security entail costly investments. In industries where turnover is high, firms may not recoup on these investments. In industries where technology determines output, the performance benefits from problem solving teams may be small.

Still, the research just reviewed compares better and poorer performing plants in the same industries. These plants are similar in many respects but those with innovative practices perform better according to a variety of measures. It is difficult to determine why these systems are not adopted by businesses which presumably would improve their performance by adopting them.

One part of the answer may be due to difficulties in changing management practices and organizational cultures. Empirical evidence routinely finds that new startups ("greenfield sites") are more likely to adopt innovative work practices than are plants that have been operating for longer periods of time (Ichniowski and Shaw, 1995; Ichniowski, 1990. Contra, see Osterman, 1995). Low rates of adoption are therefore primarily a concern among older "brownfield" sites. Why have these innovative systems of work practices diffused only slowly to brownfield sites? What are the nature of the advantages that greenfield sites have in adopting the new work systems? Current research suggests several answers.

System inertia. First, the need to change an entire system of work practices -- from a traditional set based on narrowly defined jobs, strict supervision, frequent layoffs, and seniority-based pay and promotion rules to a newer approach involving flexible job design, contingent incentive pay plans, extensive training in multiple skills and employment security initiatives -- will itself limit diffusion. As we have emphasized, economic performance is highest only when firms adopt whole bundles of work practice, and firms that adopt single practices without other necessary changes will not experience improved performance (Katz et al, 1988 OR 1987?; Ichniowski et al, 1995 OR 1994).

Levinthal (1994) develops simulations to model various ways that firms might experiment with new practices in their search for more productive forms of organization. He shows that when interaction effects among organizational policies are important determinants of performance, firms do indeed get "locked into" their initial choice of practices. Firms that experiment with individual workplace innovations and see no improvements in performance discard their innovations as failures. These results are consistent with empirical studies which find that many employee participation and quality circle initiatives are abandoned after only a few years (Lawler and Mohrman, 1987; Drago, 1988).

Linkages with other organizational practices. Part of the answer to the question of limited adoption lies in the fact that in some industries systems of innovative work policies appear to be part of a larger system of production and distribution policies. The magnitude of the economic benefits from adopting new systems in these industries may depend on characteristics of the businesses' product markets and customers.

For examples, in apparel, the full benefits of the modular production system requires that firms invest in information and order-tracking technologies to streamline the distribution channels. Furthermore, the benefits from adopting the new information technology and module production methods are greater for apparel makers whose customers insist on quick replenishment of stocks and a rapid delivery of new orders (Dunlop and Weil). In automotive industries, innovative work practices appear to be complementary with "lean manufacturing" methods such as small work-in-process inventories (MacDuffie, 1995; Helper, 1995).

For firms in these industries, switching to new work practices requires an entirely new set of production and distribution procedures and large investments in new technologies. These costs will be considerably more than the expenses of the new employment policies. Decisions to adopt these policies are not made independently but are part of a larger set of costly choices regarding the manufacturing and marketing strategies of the firm and its key customers.

Labor-management distrust. In other industries better performing plants with innovative practices and poorer performers with traditional work practices employ roughly the same production processes, customers, and distribution practices. In these cases, still other factors must be at work to limit the adoption of the productivity-enhancing work systems.

One such factor is a low level of trust between labor and management. Ichniowski and Shaw (1995, p. 50-52) cite examples at older steel mills of how participation teams were viewed as management "tricks" to cut jobs. Many employees believed management would take away contractual job security guarantees in subsequent contracts after employees offered their ideas to improve operations, and employees also suspected that newly shared financial information was coming from a "second set of books." Union leaders report that one of the biggest barriers to lasting cooperative relations occurs when an employer seeks their cooperation and partnership in existing unionized facilities, while engaging in union avoidance practices at other sites (AFL-CIO, 1994; Commission on the Future of Worker Management Relations, 1994a).

Winners and losers. While a firm's productivity may increase with the adoption of new work systems, this improved performance may not translate into better conditions for all of the firm's workers. For example, senior workers in older establishments that tie job assignments and pay rates to length of service may not fare any better under the new arrangements than they do under the more traditional arrangements under which they have worked for many years. These workers may resist changes to new systems (Goodman, 1979). Downsizing and restructuring of businesses that often precedes or accompanies the adoption of new work systems can create resistance not only among those most at risk of losing their jobs but also among the "survivors" who may feel overworked or fear they will be the next to go if productivity improvements outpace business growth (Batt, 1995). Front-line supervisors may also be particularly resistant

to new practices such as self-directed work teams which threaten supervisors' jobs. Even if supervisors' jobs are not threatened by the adoption of new work systems, the nature of the work that supervisors would perform under the new systems would be drastically different from supervisors' traditional roles (Klein, 1984).

Institutional and public policy constraints. Institutional and public policy factors outside the control of individual firms, workers or unions may also limit the diffusion of workplace innovations. One institutional constraint lies in the limited options workers have in acting on their preference for workplace innovations. A recent survey found that most workers would prefer to have greater participation on their jobs but cannot obtain greater participation on their own without some management initiative (Freeman and Rogers, 1995). This same majority also recognizes that management cooperation is essential to the success of participatory processes and may be fearful that the increased worker voice that unionization would bring might come at the expense of more adversarial labor-management relations. There is no American equivalent to the European Works Council which discuss and consult on human resource practices, including the organization of work and the division of decision-making responsibilities. Thus, the adoption of work practice innovations in non-union settings remains an employer prerogative.

U.S. financial markets and institutions may represent another constraint. To the extent that workplace innovations impose substantial and easy to observe short-run costs while the benefits are less certain and accrue over a longer term, financial agents may prefer strategies for improving profitability through short-run cost reductions or investments in easier-to-monitor assets. Thus, workplace innovations must compete with alternative strategies for boosting short-run performance not only among managers with competing preferences and interests within the firm, but with those who monitor firm performance for shareholders and large institutional investors. Within American corporations, human resource managers tend to be among the lowest paid and least influential of corporate executives, and human resource issues are reported to be of less interest to investment analysts than are short term cost and earnings projections (Kochan and Osterman, 1994; Levine, 1995). Taken together, these features of financial markets and corporate governance structures may make it difficult for advocates of workplace innovations to

attract the resources and support needed to sustain them long enough to achieve their full potential.

Current public policy poses additional constraints. For example, considerable uncertainty exists over the legality of some forms of employee participation in non-union settings. The Commission on the Future of Worker Management Relations (1994a) concluded that the systemic workplace innovations that have the largest effects on performance are the ones most at risk of violating the NLRA's ban on company dominated unions. While only a few cases have tested this provision, a majority of managers surveyed for the Commission indicated that current government policies make them cautious about broadening existing participation programs or implementing new ones (Commission on the Future of Worker Management Relations, 1994a; 53).

To summarize, though the evidence as to the reasons for the limited diffusion of workplace innovations is only suggestive, it indicates that a number of different factors are involved:

Conclusion 4: *The diffusion of new workplace innovations is limited, especially among older U.S. businesses. Firms face a number of obstacles when changing from a system of traditional work practices to a system of innovative practices, including: the abandonment of organizational change initiatives after limited policy changes have little effect on performance, the costs of other organizational practices that are needed to make new work practices effective, long histories of labor-management conflict and mistrust, resistance of supervisors and other workers who might not fare as well under the newer practices, and the lack of a supportive institutional and public policy environment.*

Conclusions

This review of an emerging body of research on the experience of U.S. businesses with workplace innovations marks the considerable progress that new studies have made in assessing the economic effects of new work practices and the reasons for their adoption. The findings from this research are supported by a broad array of studies employing diverse methodologies. For

managers the implications are clear -- there appear to be potentially large payoffs to systematic innovations in managing organizations.

Nevertheless, there are several important research gaps that future studies should attempt to address. Nearly all of the research to date focuses on manufacturing businesses, so there is need the research to the service sector. New research is needed also to address the effects of new workplace arrangements on outcomes of particular concern to workers, particularly their effects on wage structures and income inequality. Do workers share in productivity gains through higher earnings? Are earnings more volatile under work systems that typically include contingent compensation plans? Finally, further research needs to investigate more thoroughly whether new work systems work best in certain environments. Do the regular reports of large scale layoffs by major U.S. businesses indicate that new work systems are less effective in declining product markets? More generally, further research on adoption is also needed to explain the limited adoption of new work systems in many sectors of the U.S. economy. Where unions are present, are the results of new work systems different when the union actively supports the new practices than when the union resists or passive to the changes?

The research published here has involved quantitative studies. Coupled with past studies and overviews, the balance of the evidence supports the hypothesis that innovative workplace practices work, at least some of the time. These studies find enormous variation, although their above-average attention to providing rich controls (case studies such as Berg, within an industry or technology) helps reduce many sources of error. While additional measures can help, there will always be omitted variables, and quantitative studies will never explain all the variation we observe.

To complement these quantitative studies, we will always need detailed qualitative studies that can observe hard-to- quantify data can shed light on crucial details of how to implement innovative practices successfully -- in other words to get into the "black box" which explains how and why people perform as they do. Ultimately, results will only be convincing if they show up in both qualitative and quantitative studies.

Research to date has identified a number of barriers to the diffusion of successful workplace innovations. Future research must help us better understand these barriers. If these barriers appear to be due to market and government failures (as argued above), there can be a national interest in removing government barriers and in actively promoting workplace innovations. In particular, public policies must lower the transition costs that will inhibit some private decision-makers (firms, unions, individuals) from adopting or supporting these innovations even when they are effective in improving both the quality of jobs and organizational effectiveness.

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