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**High Performance Work Practices at Century's End: Incidence, Diffusion,
Industry Group Differences and the Economic Environment**

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Abstract

This study examines the incidence, diffusion, industry group differences and external economic environment predictors of new work practices in the United States in 1994 and 1997. It uses U.S. Census data from a large nationally representative random sample of establishments. The study examines experimentation with work practices by any of a establishment's employees and adoption of work practices by a majority of an establishment's employees. We find that self-directed work teams have taken off as an experimental work innovation. However, their adoption by a majority of workers in establishments nation-wide is rather modest. Their diffusion has stalled. Work-related meetings used to solve company problems have significantly higher incidence in both experimentation and adoption than self-directed work teams. However, their diffusion has also stalled. High performance workplaces are a negligible phenomenon affecting about 1% of establishments nation-wide. They have not risen significantly from 1994-1997. There appears to be more convergence than divergence among industry groups in work innovations. Measures of industry group export levels and growth significantly predict increases in most measures of work innovation for individual establishments in 1994 and 1997. Measures of the exports of individual establishments also significantly predict increases in most measures of work innovation by these establishments in 1994. Measures of industry group import levels and growth significantly predict decreases in most measures of work innovation for individual establishments in 1994 and 1997.

Introduction

For more than a quarter century the use of new work practices in industry has interested industrial relations researchers. A clear *national* picture and a better understanding of the determinants of the nature of their incidence and their diffusion still evades us because of pervasive inconsistencies in defining, measuring, and sampling these practices and wrong impressions created by a variety of industry group studies

Empirical Literature

The employer-reported empirical literature can be categorized into three groups. (Table 1) The first group of studies is national in scope and has strictly emphasized the performance impacts of a variety of new work practices. (Kalleberg 1996; Delaney & Huselid 1996; Becker &

Huselid 1998ab; Becker, Huselid, Pinkus, & Spratt 1997; Black & Lynch 1996, 1997; Delaney & Huselid 1996; Huselid 1995; Huselid & Becker 1995, 1996, 1997; Huselid & Rau 1998; Ichniowski 1990; Lynch & Black 1995, 1998; Cappelli & Neumark 1999; see also Levine 1995 and Mitchell, Lewin, & Lawler 1990 for a synthesis of research and a review of earlier studies.) While providing evidence on the financial and operational performance impacts of high performance work practices, they typically do not report on the actual incidence of the individual practices or high performance workplaces whose impact they are measuring. They also include virtually no data on industry group differences or external environmental predictors of individual practice or the high performance workplace.

The second group of studies is also national in scope. They have focused principally on questions of incidence. These studies include virtually no data on industry group differences or external environmental predictors of the high performance workplace or individual practices. (Commission on the Skills on the American Workforce 1990; Delaney, Lewin, & Ichniowski 1989; Freeman, Kleiner, & Ostroff 1997; Gittleman, Horrigan, & Joyce 1998; Lawler, Mohrman, & Ledford 1998; National Center on the Educational Quality of the Workforce 1995; Osterman 1994, 1999). As Table 1 indicates, they have principally focused on larger public companies with little economy-wide emphasis. Most of the samples are of modest size.

The third group of studies deals with specific industry groups. (Arthur 1992, 1994 on steel; Bailey 1993, Dunlop & Weil 1996, Hwang & Weil 1998 on textiles; Brown 1996, 1997 on semiconductors; Delery & Doty 1996 on banking; Doeringer, Evans-Klock, & Terkla 1998 on manufacturing; Bartel, Freeman, Ichniowski & Kleiner 1999; Ichniowski, Shaw & Prenzushi 1997

on steel; Kelley 1996 on machine tools; Luthans & Sommer, 1998 on rural electric utilities; MacDuffie 1995 and Pil & MacDuffie 1996 on automobiles; Snell & Dean 1992 and Youndt, Snell, Dean, & Lepak 1996 on metal-related manufacturing). As Table 1 indicates, these studies were preoccupied with manufacturing, especially, auto, steel, and metal-related industries, although there have been studies in textiles. A rather large gap exists in the area of services, especially retail and wholesale trade and health services, which collectively make up over 50% of establishments in the United States. (See Table 5).

A fourth group of studies explores the case literature. (Cutcher-Gershenfeld, Kochan, & Verma 1991, Macy and Izumi 1993, and Appelbaum & Batt 1994 provide a comprehensive analysis; Kossek 1989 on insurance; Batt 1995 on telecommunications; Berg, Appelbaum, Bailey, & Kalleberg 1996 on textiles; Bernhardt & Slater 1998 and Hunter & Lafkas 1998 on banking; Brown 1996, 1997 on semiconductors (involving separate studies by Rashler, Valvano, and Appleyard); Voos, Horton, & Moeser 1995 on the paper industry; Adler & Cole 1993 and Rubenstein, Bennett, & Kochan 1993 on the auto industry. Another group of studies that principally focus on the differences between union and nonunion firms is beyond the scope of the current broader examination and will be investigated in a separate paper. (See for example, Eaton & Voos 1994 and Delaney 1996.)

The term *experimentation* will be used to refer to a work innovation that has been implemented with any proportion of an establishment's employees. Moreover, the term *adoption* will be used to refer a work innovation that has been implemented with more than 51% of an establishment's employees. This approach has been used in similar studies by other

researchers. (Osterman 1994, 1999).

Self-Directed Work Teams. One critical question is the incidence and the diffusion of self-directed work teams in the nineties. Unfortunately, there is contradictory data on this question because of inconsistent results from both random and non-random surveys. Sector studies and those that examine “core employees” often suggest that there is a relatively high incidence of such teams. For example, in one study 22.4% of auto assembly plant workforces were in teams with the number reaching 70.2% in a high performance group in 1989. The high performance workplace group made up about a quarter of the sample. (MacDuffie 1995: 211). The International Motor Vehicle Project found the percent of employees in teams had grown from 15.7% in 1989 to 46.3% in 1993. (Pil & MacDuffie 1996: 437) A more recent survey of 1,150 Japanese transplants in the U.S. showed that 33.4% had adopted self-managed work teams for a majority of their workers. (Jenkins and Florida 1999) In 1992 and 1997, the National Establishment Survey collected data on “core employees” who were defined as the largest group of non-supervisory workers directly involved in the production of a good or service. While based on national random sample, results for “core employees” are likely to be much higher than surveys covering all an establishment’s employees. Reports on this survey do not specify the industry group composition of these samples in detail. In 1994, 54.5% of 806 business establishments with more than fifty employees report experimenting with teams and 40.5% report adopting self-directed work teams. In 1997, 38.4% of 674 establishments report adopting such teams. In a further analysis using a much smaller longitudinal sample from both years, the author concludes that the incidence of such teams has remained the same and that the diffusion has stalled over the 1994-1997 period at around the 40% level of adoption. (Osterman 1994,

1999).

Several other studies suggest that the “core employee” approach yields national estimates of incidence that may be optimistic. A 1993 U.S. Bureau of Labor Statistics national random sample looked at over seven thousand establishments. It found that only 14.2% of all establishments and 32% of establishments with more than 50 employees experimented with “worker teams”. (Gittleman, Horrigan, & Joyce 1998:105). Unfortunately, this study did not report data on adoption of teams for a majority of employees. Consequently, the relatively high adoption figures of the much smaller National Establishment Survey study could not be confirmed. In addition, the BLS study did not focus on “core employees.” In 1994, preliminary reports of findings of a national random sample of the U.S. Bureau of the Census’ National Employer Survey of establishments reported that the average percentage of non-managerial employees involved in self-directed work teams was 13% among establishments of 20 or more employees. (National Center on the Educational Quality of the Workforce, 1995.)

Work-Related Meetings. The incidence and diffusion of work-related meetings has also not been clearly established. These deal with “off-line” information-sharing and problem-solving. Most of the studies focused on firm performance in Table 1 and simply do not report incidence and diffusion data on work-related meetings. Moreover, when they do report incidence data, survey questions are often phrased so that it is unclear whether they are measuring “online” self-directed work teams, work-related meetings or both. In the random National Establishment Survey, 27.4% of establishments reported having quality circles that covered more than half of the “core employees”. This figure had grown to 57.7% in 1997, a more than 200% increase. In a further

analysis using a panel data set from both years, the author concluded that the incidence of quality circles had grown by a similar amount over the 1994-1997 period. (Osterman 1994, 1999). The emphasis on “core employee” appears to push these estimates upwards. For example, the much larger 1993 U.S. Bureau of Labor Statistics random survey found that only 4.8% of all establishments and only 15.8% of establishments with more than 50 employees even report that they had quality circles. (Gittleman, Horrigan, & Joyce 1998: 105). This survey did not report on the percent of employees covered. The author of the National Establishment Survey concedes that the BLS findings on teams and quality circles are lower: “With the exception of TQM these rates are below those of the National Establishment Survey when that survey considers any use of the practice regardless of penetration.” (Osterman 1999: 6)

Other factors further complicate the problem of measuring the incidence and diffusion of work-related meetings. In 1993, a non-random Fortune 1000 sample has 51% of companies experimenting with quality circles and 15% adopting quality circles. In addition, it reports 57% experimentation and 35% adoption of other employee participation groups. Based on Fortune 1000 data since 1987, the authors of this study observed that quality circles were actually on the decline. (Lawler, Mohrman, & Ledford 1998) By 1996, the Fortune 1000 sample reported 48% experimentation and 12% adoption of quality circles. It cited 56% experimentation with and 38% adoption of other employee participation groups. How can the Fortune 1000 data on a decline since 1987 and a stalling from 1993-1996 be the case among larger corporations when surveys like the National Establishment Survey report an over 200% increase in the incidence among establishments from 1994-1997? Upon closer examination, the Fortune 1000 sample also measured a variety of other information sharing and problem solving groups and separately

reported these findings. The National Establishment Survey and the BLS survey continued to ask questions about “quality circles” although a myriad of other “off-line” group consultation mechanisms had developed during this period. In our view, the principal problem in measuring work-related meetings is that particular surveys often measure an individual member of an extended family of “off-line” practices rather than the entire family of relevant practices. The U.S. Census Bureau finally introduced a more comprehensive measure in its National Employer Survey in 1994. This measure cuts down on the confusion of measuring similar “off-line” practices that are known by different names across the country and in individual companies. Instead, it focuses on the regularity of the meetings and the specific issues which employee discuss in these meetings as an indicator of their seriousness. In 1994, the Census data shows that the average percentage of non-managerial employees involved in “regularly scheduled meetings to discuss work-related problems” in establishments over 20 employees was 54%. (National Center on the Educational Quality of the Workforce, 1995).

The High Performance Work Organization. There has been a growing consensus among many researchers that a high performance workplace ought to comprise the following practices, which should be organized into a coherent system: intensive recruitment and selection procedures, sharing information with employees, training them with the skills to perform effectively, rewarding them based on their performance, and providing opportunities for employee involvement in changing the way the work itself and work roles are organized. (See Becker & Huselid, 1998a who review work on this issue in detail; see also, Arthur, 1994; Ichniowski, Shaw & Prennushi, 1997; Jackson & Schuler, 1995; Levine 1995; MacDuffie, 1995; Pfeffer, 1998). Another theoretical perspective also emphasizes the role of guarantees in the areas of individual

rights and employment security. (Levine & Tyson 1990). The perspective that aligns human resource systems with competitive strategy and the firm's environment is often called strategic human resource management. While researchers agree that combining these elements ought to comprise a coherent system, they also agree that it is very difficult to implement these separate practices as a coherent system. Despite the overall conceptual consensus, the actual combinations of new work practices used by these researchers have varied considerably. Little debate has taken place about which combinations deserve to be described as coherent systems. (See Cappelli & Neumark 1999, Becker and Huselid 1998ab and an earlier discussion by Levine 1995). This model has been applied mainly to industry studies. Not one national random survey has used this conceptual model to report national incidence data of high performance work organizations by combining a large number of these practices together.

Four surveys of high performance workplaces in several non-random samples of large public companies in 1992, 1994, 1996, and 1998 (Huselid 1995; Huselid & Becker 1995, 1997) do provide some incidence data. These researchers introduced an index for the purpose of measuring the proportion of the workforce involved in high performance activities in the areas of staffing, development, appraisal and rewards, communication, organizational design, effectiveness of the human resource function, and human resource strategy. In the 1996 study, 697 firms are sorted into clusters that have relevance for the link between the high performance workplace and firm performance. (Becker & Huselid 1998b: 9) The High Performance Cluster had 266 firms that are well above average on implementation alignment and the use of high performance work practices. That number of firms would represent 38.1% of the national sample of 697 firms used in this particular study. The High Performance Clusters had an average impacts on the market

value of the firm of 65%. (Becker & Huselid, 1998b: 12; 1998a: 89, 91; Huselid & Becker 1997: 9-12.) These studies share a number of additional characteristics that could produce higher rates of incidence: a. They employed headquarters data; b. They dealt with larger public firms; c. they are nonrandom; and d. The high performance workplace definition used was heavily weighted towards performance-based reward measures rather than organizational measures. These studies have made the case for a strong connection between the high performance workplace and firm performance. A recent analysis of U.S. Census data makes a different case. This study says that high performance work practices raise average compensation. The study uses some limited combinations of practices. The effects of work practices on performance are positive but not statistically significant. Labor cost increases tend to offset any productivity increases that may occur. (Cappelli & Neumark 1999: 39)

Other studies raise further questions. The 1992 and 1997 National Establishment Surveys “*arbitrarily* credited an establishment with being a HPWO (high performance work organization) if it had two or more practices in place with fifty percent penetration.” (Osterman 1999: 13) This study defined a High Performance Work System as an organization in that had at least two of the following four work practices: self-directed work teams, job rotation, quality circles, or total quality management. For 1992, this study reported that “By this definition, 36.6% of the entire sample, 43.0% of non-manufacturing establishments, (and) 35.9% of manufacturing establishments are of the new breed. These estimates are considerably higher than those commonly cited.” Because the study dealt with core employees, the author suggests the figures may be inflated. (Osterman 1994: 178). By 1997, this study concluded that high performance work organizations had risen from 37.3% of his sample to 71.4% of his sample.

This was based on a panel data set of 457 establishments reporting in both years. Indeed, 81.5% of establishments that met this definition of a high performance work organization in 1992 maintained their status in 1997.

The only random sample which used a much larger number of establishments (7000 compared to 457) than the National Establishment Survey does not appear to lend support to this high level of incidence. The BLS 1993 study found that 58% of all establishments and 30.6% of establishments with more than 50 employees had zero of six practices. The practices included self-directed work teams, total quality management, quality circles, job rotation, peer review of performance, and worker involvement in purchase decisions. Only 0.4% of all establishments and 1.3% of establishments with more than 50 employees had all six practices and 95.6% of all units and 89.5% of units over 50 employees had three or fewer of the practices. These are very conservative numbers. We would note that the BLS study only measured experimentation and not adoption of the practices.

Industry Group Differences. Industry differences in incidence and diffusion have not been reported by most of the studies in Table 1. Even those studies that focused on industry groups typically emphasized only the reporting of regressions to predict performance effects. They typically did not report incidence data or reported it in a format that can not be readily translated into a clear picture. Thus, it has been very difficult to examine industry differences even when comparing different industry studies of similar practices! A 1996 national non-random study uses standardized scores in a 24-item High Performance Workplace Index and concludes “Despite the fact that there is a statistically significant difference in the HPWP index across

industry categories, except for Financial Services and Mining & Extraction the industry averages are remarkably similar.” (Becker & Huselid 1998: 81-83; 89). Across most studies, there is no consistent and clear evidence of which industry groups have high incidence in new work practices or high performance workplaces although some studies have suggested that there is more diffusion of these practices in manufacturing.

Economic Environment. Regarding external environmental influences on the incidence of new work practices, some researchers have proposed that firms “are driven by market imperatives to develop more efficient organizational structures and practices”. (Huselid 1995; Huselid & Becker 1995:2). Another theoretical perspective describes how product, labor and capital markets could possibly affect work innovation. (Levine and Tyson 1990) Another researcher has noted that “systematic studies of the determinants of adoption are extremely sparse...that is, there is little or no research that takes work organization as the dependent variable and tests hypothesis found in the literature”. (Osterman 1994:174) Many of the studies in Table 1 examine a wide variety of mainly *internal* environmental predictors of work innovations such as company size, union status, type of manufacturing system, the degree of internal alignment of the practices, and competitive strategy. There are many suggestions that the external competitive environment, particularly foreign competition and other external performance pressures may play a role in the incidence of work innovations. However, these are based on the results of opinion measures that were given to managers. (Osterman 1994; Lawler, Mohrman, & Ledford 1998).

Theory and Hypotheses

Theories of innovation provide a useful perspective for our assessment of the current

national state of new work practices and high performance workplaces. The most comprehensive review is the book of Everett Rogers entitled *Diffusion of Innovations*. (1995; see also Kossek 1989). He says that the diffusion of innovations is mainly a social process involving interpersonal networks. He writes that “Information about an innovation is often sought from near-peers, especially information about their subjective evaluations of the innovation.” (Rogers, 1995: xvii) Using computer modeling, Abrahamson has suggested how social networks might influence innovation diffusion. (1993, 1996) Recent research has confirmed that practitioner and consultant-related sources of information on human resource management are used much more frequently than academic research-related sources of information. (Terpstra & Rozell, 1997). Nevertheless, exactly how these networks might operate in the diffusion of new work practices is open to some considerable debate. There is some evidence that industry groups use social networks in innovation diffusion. (Czepiel 1975; Rogers 1995: 377). There are also reasons for reaching an opposite conclusion. It is possible that levels and variations in imports, exports, employment growth and perhaps a host of other external economic environmental variables actually determine the incidence and diffusion of new work practices. This perspective puts a lot of emphasis on objective economic conditions affecting industry groups. Along these lines, Rogers also has emphasized that the use of an innovation often begins with a need connected to a problem. The implementor comes to recognize the innovation as a solution to that problem. (Rogers 1995: 162). Hassinger (1959) argues that individuals will generally not consider an innovation without really needing it. An example of this approach would be the claim that high exports in two different industry groups account for the similar diffusion of new work practices in these two industry groups. The extensive case studies of the Minnesota Innovation Research Program at the University of Minnesota Business School concluded that innovations are not

initiated impulsively. (Schroeder, Van de Ven, Scudder, & Polley, 1986) As Rogers notes, “Most organizations engage in an opportunistic surveillance by scanning the environment for new ideas that might be beneficial to the organization.” This again points in the direction of the importance of economic environment variables. Rogers’ review of research over several decades in many different fields of social research from the incidence and diffusion of agricultural innovations among farmers to the incidence and diffusion of technological innovations in the general economy has uncovered remarkably similar findings across disciplines. (Rogers 1995: 38-95). Hardware technology innovations are more visible and take off faster. Technological innovations that are almost entirely made up of information and which “only have a software component...have a relatively lower degree of observability and thus a slower rate of innovation.” (Rogers, 1995: 13) This suggests that new work practices that are largely a “software” application will have an initial incidence and a diffusion rate slower than computer technology.

Our application of theories of innovation to new work practices and high performance work organizations has resulted in five hypotheses that can be empirically tested by the U.S. Census data set. The first hypothesis is that self-directed work teams for non-managerial employees will have widespread experimentation but significantly lower adoption nationally. Because they will require intensive organizational change to implement and are less familiar and embedded in the social system, we predict that their adoption by establishments for a majority of employees will be substantially less than the experimentation with such teams among any proportion of the employees of establishments. The second hypothesis is that work-related group meetings for non-managerial employees will achieve both widespread experimentation and adoption nationally. We predict that this will be the case because work-related meetings for

non-managers can be more easily identified with past behaviors in the workplace such as meetings of various types that have been commonly used in and outside the workplace. The third hypothesis is that combinations of new work practices into High Performance Workplaces will be implemented by an extremely small number of establishments nationally. The reason is that the transformation of a workplace according to the theories of strategic human resource management will be extremely time-consuming and complicated. The alignment of several human resource management subsystems will significantly challenge the familiarity and the embedded social relations of a firm and require extensive alternations to its organizational software. Rogers strongly recommends studying sets of innovations in a system where separate practices are interdependent. He claims that the individual practice method of studying innovations actually distorts reality because innovations typically are packaged together. He stresses that innovations tend to be promoted and adopted in “technology clusters”. (Rogers 1995). He believes that “the boundary between innovations ought to be determined by the potential adopters who do the perceiving.” This is also important because adopters tend to modify and reinvent innovations. (Rogers 1995: 14). This closely echoes the approach of Becker and Huselid (1998ab) who argue that the relevant new work practices should be grouped into an additive index. In their view, an additive index allows different firms to emphasize different new work practices depending on the fit between these practices and the firms’ problems and environment. It recognizes that there are different paths to coherence. While alternative approaches may have some merit, our study uses an additive index that measures extensive use of the individual work practices.

The fourth hypothesis is that industry group differences will be a strong predictor of both the incidence and the diffusion of self-directed work teams, work-related meetings for non-

managers, and high performance workplaces. The testing of this hypothesis will help resolve the apparently contradictory claims about the role of industry group differences versus external economic environment effects. Scholars in strategic human resource management and organizational change also emphasize the pressures on institutions to become similar and stress the special relevance of industry groupings (see Jackson & Schuler, 1995:240; DiMaggio and Powell, 1983). The fifth hypothesis is that objective measures of turbulence and uncertainty in the external economic environment of an industry group, specifically imports and exports, will predict the incidence of high performance workplaces and new work practices in individual establishments within that industry group controlling for size, and union/nonunion differences. This hypothesis postulates that members of different industry groups deal with their natural resistance to the newness of work innovations by scanning their external environment for information that may or may not hint that organizational transformation may be in order because of an economic motivation. Strategic human resource management researchers have emphasized that the impact on firm performance of work innovations depends precisely on the external fit between a firm's system of human resource management practices and its competitive strategy. (Becker & Huselid, 1997; Jackson, Schuler & Rivero, 1989). In a wide-ranging review of theoretical work on human resource practices and organizational environments, Jackson and Schuler (1995) argued that despite substantial evidence of the value of certain best practices, U.S. employers have been slow to adopt best practices. Moreover, they assert that the acontextual nature of the scientific evidence is part of the problem. They call for an exploration of the relationship between these practices and the internal and external environments of organizations. Regarding the external environment, they particularly mention forces in the same industrial sector among others (1995:240; 251) and suggest that macro-micro linkages have been largely ignored.

Data and Methodology

The National Employer Survey of the U.S. Census is a unique nationwide survey of workplaces in both 1994 and 1997. It was administered to a nationally representative sample of private establishments with 20 or more employees. The analysis of this available data set constitutes a reasonable next step to resolving the contradictions in the literature because of pervasive inconsistencies in defining, measuring, and sampling these practices. In testing each hypothesis, we will use an analysis of 1994 and 1997 incidence data and regressions. We will supplement this with some diffusion data over the brief 1994-1997 period from the U.S. Census work survey although this is not the major focus of our study. The major purpose of the Census survey was to focus in detail on training and school to work issues. In order to accomplish this, it used extensive questions on establishment and workforce characteristics, equipment and technology, employment, work organization, and compensation and benefits. The 1994 survey comprises 65 questions and the 1997 survey comprises 61 questions. This survey is particularly suited to a study of new work practices and high performance workplaces because it does not obviously focus on a small number of questions dealing with these issues. This might reduce the probability of response bias by workplaces with high performance practices. Moreover, the data on work practices are more likely to reflect facts because they are drawn from site supervisors at establishments rather than executives at headquarters of large firms. They are close to where the practices were established and operate. (Cappelli & Neumark 1999) The survey was designed so that an analysis can be used that is weighted to be nationally representative of all establishments over 20 employees for the nation and for different establishment size categories and industry groups. The actual number of establishments in each industry group in the 1994

and the 1997 samples is shown in the last column of Table 5. The percent of establishments in various industry groups and size categories which was used to weight the findings to be nationally representative is also shown in this Table. These weightings were assigned by the Census.

The U.S. Bureau of the Census conducted the 1994 survey for the National Center on the Educational Equality of the Workforce at the University of Pennsylvania. The 1997 survey was administered by the U.S. Bureau of the Census and jointly supported by the National Center for Post Secondary Improvement and the Consortium for Policy Research in Education. While the surveys have some distinct limitations, they represent one of the most far-reaching quantitative assessments of work innovations. The Census Bureau administered the 1994 survey in August and September of 1994 to a nationally representative sample of private establishments with more than 20 employees that represents approximately 75% of all workers. The 1997 survey was administered between June and August of 1997 to a similar sample. The Census Bureau used their Standard Statistical Establishment Listing establishment database as the sampling frame. This is one of the most comprehensive and up-to-date listings of establishments in the United States. In 1994, 4,633 eligible establishments were contacted. In addition, 3,358 participated in the survey for a 72% response rate. We have usable data for 3167 establishments. In 1997, 3,081 participated in the survey for an overall response rate was 78%, that is, 1,827 establishments in manufacturing and 1,254 establishments in non-manufacturing. One disadvantage of this data set is that it is based on managerial self-report which can be biased. Nevertheless, this problem is common to all such studies. Another disadvantage is that the data on diffusion only covers the 1994-1997 period with levels from previous periods unknown.

Our study uses two cross-sectional data sets for 1994 and 1997 to estimate the incidence of new work practices measured in both years and combinations of new work practices called the high performance workplace covering 20 industry groups. We use regressions to estimate the impact of industry groups or economic environment variables on new work practices, which are the dependent variables. For independent variables, we use industry group dummy variables from the National Employer Survey and economic environment measures based on manufacturing industry group data from the National Income and Product Accounts (NIPA) data set on imports, exports, output, employment and profit margins. Industry group measures of economic turbulence are used to predict the incidence of work innovations in 1994 and 1997 in establishments. One exception is exports. We also use 1993 data on the exports of individual establishments to predict measures of that establishment's work innovation.

This study focuses on eight measures of work innovations and one High Performance Workplace Index that constitute the dependent variables: *Self-Directed Work Teams*, the percentage of non-managerial and non-supervisory employees currently involved in self-managed teams (1994: Q53, 1997: Q21), *Work-Related Meetings*, the percentage of non-managerial employees involved in regularly scheduled meetings to discuss work-related problems [the items discussed in work-related meetings including working conditions, health and safety, choice of new technology or equipment, ways to improve specific tasks] (1994: Q49, 1997: Q22ab), *Training*, the average hours of training for each employee category in the last year (1994: Q27, 1997: Q45), *Benchmarking*, participation in benchmarking (1994: Q47, 1997: Q19), *Job Rotation*, the percentage of non-managerial and non-supervisory employees currently involved in

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job rotation (1994: Q52, 1997: Q23), *Flatness of the Organization*, the levels between a first line supervisor and the top official in the establishment (1994: Q54, 1997: Q24) and the average number of employees who report to each first-line supervisor (1994: Q56, 1997: Q25), *Recruitment*, the percent of total labor costs spent on recruitment and selection of employees for the establishment (1994: Q 58, 1997: Q29), *Position on Pay and Benefits*, the average hourly pay for different categories of workers (1994: Q 62, 1997: Q26), whether employees are covered by pension plans and medical or health insurance (1994: Q63ac, 1997: Q27ac).

A High Performance Workplace Index was constructed from these 8 variables to measure the extent of high performance practices in the major human resource management subsystems. There is a maximum score of eight.¹ This is an additive index comprised of the items listed in Table 2 that measure these subsystems for the 1994 and the 1997 surveys separately. We divide establishments in the sample into three groups based on the extent of their combination of these practices. Strong Innovators combine more than four or half of the eight practices. Medium Innovators combine three to four practices. Weak Innovators combine zero to two practices. Strong Innovators are synonymous with High Performance Workplaces. The basis for this determination is that a reasonable expectation of a high performance workplace is that it would implement more high performance work practices than it chooses not to implement.

¹ Establishments not only have to be implementing practices with a majority of their employees in teams, meetings, and job rotation but they have to be above average on the other measures. One colleague has commented that if everyone were a strong innovator on the innovations requiring above average performance, only half would be recognized as high performers by this index. This would indeed be true if there was little variation in these measures. However, there is substantial variation in each of these measures and many establishments have very low scores. Our measure really does capture who is innovating seriously on these practices. These variability computations are available from the authors. Actual dollar amounts of employee pay are available for managers, supervisors, technicians, office/clerical/sales/customer service workers and production workers. This data is not available for different jobs within these categories.

While the entire question of how to define such workplaces merits further study, we suggest that this approach makes more sense than arbitrarily grouping a small number of practices that do not reflect the major human resource management subsystems. The use of one additive index has been the general preference of past empirical work. (Arthur 1994; Delaney, Lewin, & Ichniowski 1989; Huselid 1995; Huselid & Becker 1995; Huselid & Becker 1997; Ichniowski, Shaw & Prensushi 1997; MacDuffie 1995; Youndt 1996). Other researchers as reported above have tried some form of arbitrary clustering. (Gittleman, Horrigan, & Joyce 1998, Ichniowski 1990; Lawler, Mohrman, & Ledford 1998; Osterman 1994, 1999). Other researchers have constructed ideal prototypes based on various combinations of workplace practices for regression studies of performance. (Black & Lynch 1997) or used smaller bundles. (Cappelli & Neumark 1999). In their review of research on high performance work systems and firm performance, Becker & Huselid (1998a: 63-64) note that the additive approach certainly has its limitations, but a single index does reflect the notion of the work system as a strategic asset. Namely, it implies that there are multiple ways to achieve a high performance workplace. For this reason, in their studies as in ours, factor analysis has intentionally not been used as a method in creating the index.

Results

The first hypothesis is that self-directed work teams for non-managerial employees will have widespread experimentation but significantly lower adoption nationally. The hypothesis is confirmed. The incidence of self-directed work teams was about three times larger as an experiment when we measure establishments that use it with any segment of their workforces than when we measure establishments that adopted the practice with a majority of the

workforces nationwide. Table 3 indicates the incidence of experimentation and adoption in 1994 and 1997. It is weighted to be nationally representative of establishments over 20 employees. In 1994, 31.8% of workplaces had any self-directed work teams and 8.6% of these had more than half of their workers involved in teams. The average percent of workers in self-directed work teams in all workplaces (with or without teams) was 13%. The average percent of workers in self-directed work teams in those workplaces only with teams was 41.1 %. In 1997, 34.2% of workplaces had any self-directed work teams and 12.2% of these had more than half of their workers involved in teams. The average percent of workers in self-directed work teams in all workplaces (with or without teams) was 15.5% and the average percent of workers in self-directed work teams in those workplaces only with teams was 45.3%.

A (++) or (--) in Table 1 in the 1997 column indicates whether the diffusion of the practice from 1994 to 1997 represents a statistically significant increase or decrease at the 95% level of confidence. Experimentation with such teams increased modestly by only 2.4% between 1994 and 1997 for an average actual annual growth of 0.8 percent and a growth rate over the period of 7.5%. This did not constitute a statistically significant increase at the 95% level of confidence. Adoption increased 3.6% from 1994-1997 for an average annual growth of 1.2% or a growth rate over the period of 41.8%. This increase was statistically significant. The average percent of employees in teams only in those workplaces with teams grew by 4.2% for an average actual annual growth of 1.4% or a growth rate over the period of 10.2%. This was not statistically significant. And the average percent of employees in teams across all establishments grew only 2.5% for an average annual growth rate of 0.83% or a growth rate over the period of 19.2%. This growth was also not statistically significant. Regarding the previous empirical

literature, these findings demonstrate that studies of “core employees” may indeed overestimate the number of establishments experimenting with and adopting such teams and impressions from auto industry and Japanese transplant studies and non-random surveys cannot be confirmed.

The second hypothesis is that work-related group meetings for non-managerial employees will achieve both widespread experimentation and adoption nationally. This hypothesis is largely confirmed. Table 4 indicates the incidence of both experimentation and adoption in 1994 and 1997. It is weighted to be nationally representative of establishments over 20 employees. The incidence of experimentation with this practice involves over three-quarters of all establishments in both 1994 and 1997. The incidence of adoption involves about half of all establishments in both years. An average of 65-76% of all employees participates in the practice in both years. A (++) or (--) in this table in the 1997 column indicates whether the diffusion of the practice from 1994 to 1997 represents a statistically significant increase or decrease at the 95% level of confidence. We see that the diffusion of work-related meetings has also stalled over the period. Regarding the previous empirical literature, these findings demonstrate that a comprehensive measure of off-line work-related meetings may indeed resolve the inconsistencies between a variety of past studies which measure individual practices of what we now suggest may be a general family of practices. Our interpretation of these findings is that work-related meetings have gone this far because they pose less threat to existing organizational patterns than self-directed teams.

The third hypothesis is that combinations of new work practices into High Performance Workplaces will be implemented by an extremely small number of establishments nationally.

Table 5 indicates the incidence of High Performance Workplaces in 1994 and 1997. It is weighted to be nationally representative of establishments over 20 employees. A (++) or (--) in this table in 1997 indicates whether the diffusion of the practice from 1994 to 1997 represents a statistically significant increase or decrease at the 95% level of confidence. In 1994, only 1.05% of workplaces nationally were Strong Innovators. Medium Innovators comprised 14.44% of establishments and 84.56% were Weak Innovators. In 1997, Strong Innovators increased to 1.14% and Medium Innovators increased to 15.79%, while Weak Innovators decreased slightly to 83.08%. The average annual growth rates and the overall growth rates from year to year are obviously meaningless. The changes in all three categories between 1994 and 1997 are not statistically significant. Hypothesis 3 is supported. High Performance Workplaces are implemented by an extremely small number of establishments nationally and the diffusion of this innovation has clearly stalled according to these results. While our findings do make use of the strategic human resource management theoretical model, they are more in line with the only other large national random sample, the Bureau of Labor Statistics survey in 1993. Even if we were to significantly dilute our definition of the high performance work organization so that all Medium Innovators would be redefined as Strong Innovators or high performance work organizations, our conservative finding about the incidence of such workplaces would still stand.

The fourth hypothesis is that industry group differences will be a strong predictor of the incidence and diffusion of self-directed work teams for non-managers, work-related meetings for non-managers, and high performance workplaces. This hypothesis is not confirmed. Tables 3, 4 and 5 indicate incidence data in 1994 and 1997 for these practices and diffusion data from 1994 to 1997 for these practices. Regressions were estimated to see whether industry groups differed

significantly from one another in each year and in the 1994-1997 period change. While some significant differences appear, we would expect 5% of our tests to be significant simply as a result of random variation at the 95% level of confidence. For measures of incidence, within any one year's column in these three tables, a + or a - indicates that an industry group significantly differs from the average incidence of all other industry groups for that year at the 95% level of confidence. We observe that for all practices industry group differences simply are not a strong predictor of incidence differences in 1994 or 1997 or the period change. There appears to be more convergence in the national picture than divergence between the industry groups.

The fifth hypothesis is that objective measures of turbulence and uncertainty in the external economic environment of an industry group, specifically imports and exports, will predict individual new work practices and combinations of these practices in individual establishments within that industry controlling for size, and union/nonunion differences. We use industry group measures of import and export levels and growth to predict ten measures of work innovations in 1994 and 1997 in establishments using Probit (for measures 1-2, 4-5, and 7-10 below) and OLS regressions (for measures 3 and 6 below). The ten dependent variables of work practices are:

1. If any employees in an establishment are in teams (experimentation);
2. If a majority of employees in an establishment are in teams (adoption);
3. The average percent of employees in teams in an establishment;
4. If any employees in an establishment are in work-related meetings; (experimentation);
5. If a majority of employees in an establishment are in work-related meetings (adoption);
6. The average percent of employees in work related meetings in an establishment;
7. The total High Performance Workplace Index score of an establishment;
8. The probability of an establishment being a Weak Innovator;
9. The probability of an establishment being a Medium Innovator;
10. The probability of an establishment being a Strong Innovator.

These are the ten measures of work innovations reported in Tables 3,4, and 5 for the earlier

hypotheses. The models use import and export levels for the previous year and import and export growth for the previous ten-year period as the independent variables. The model is applied to both the 1994 and the 1997 National Employers Survey data separately. Unlike previous studies, this is an attempt to directly measure competitive conditions, rather than to measure managers' attitudes and opinions about such conditions. Table 6 shows the weighted means and standard deviations for the variables, the NIPA data for manufacturing industry groups, and the results for all regression specifications for both years. The findings for the 1994 analysis closely parallel the findings for the 1997 analysis. The hypothesis is confirmed.

Overall, imports discourage work innovation. We examined whether import growth from 1983-1993 and import levels in 1993 predicted the ten measures of work innovation in individual establishments in the 1994 survey. Then, we examined whether import growth from 1984-1994 and import levels in 1994 predicted the ten measures of work innovation in individual establishments in the 1997 survey. With 10 dependent variables and 2 independent variables for the 1994 and the 1997 surveys separately, this involved 40 regressions. Import growth predicts negative innovation on 17 of 20 measures of work innovation in 1994 and 1997. The import level predicts negative innovation on 14 of 20 measures of work innovation in 1994 and 1997. The following discussion will demonstrate how the results for 1994 are practically meaningful.

The average import level for 1993 was 15.4%. A one standard deviation increase in import level (equivalent to a 9.6% point change) was associated with a - 0.15 change in the overall index score, but impacts on individual practices were practically more meaningful. It was associated with a 3.9% increase in the probability of being in the Low Innovation category

(which means reduced innovation) and a 3.5% decrease in the probability of being in the Medium Innovation category. This is quite meaningful since, for example, only 13.3% of firms are in the Medium Innovation category in 1994. A one standard deviation increase in the import level was associated with a 2.9% decrease in the percent of workers in teams, again quite meaningful since only 13% were in teams on average in that year. It was associated with a 5.8% decrease in the probability of experimenting with teams and a 2.3% decrease in the probability of adopting teams. It was associated with a 4.5% decrease in the average percent of workers in meetings, a 1.1% decrease in the probability of experimenting with meetings and a 4.8% decrease in the probability of adopting meetings.

The average increase in imports over the 1983-1993 period was 5.55%. A one standard deviation increase in imports over this period was associated with a decrease of .10 in the overall index score. This is not large, but other effects are quite notable. The average increase in imports was associated with a 2.2% increase in the probability of being in the Weak Innovator group. (This means reduced innovation). It was associated with a 1.8% decrease in the probability of being in the Medium Innovator group. It was associated with a 1.7% decrease in the percent of workers in teams, a 3.3% decrease in the probability of experimentation with teams and a 1.4% decrease in the probability of adopting teams. It was also associated with a 2.7% decrease in the percent of workers in meetings, a 3.2% decrease in the probability of experimenting with meetings and a 2.6% decrease in the probability of adopting meetings.

Overall, exports encourage work innovation. We examined whether export growth from 1983-1993 and export levels in 1993 predicted the ten measures of work innovation in individual

establishments in the 1994 survey. Then, we examined whether export growth from 1984-1994 and export levels in 1994 predicted the ten measures of work innovation individual establishments in the 1997 survey. With 10 dependent variables and 2 independent variables for the 1994 and the 1997 surveys separately, this involved 40 regressions. Export growth predicts positive innovation on 16 of 20 measures of work innovation in 1994 and 1997. Export level predicts positive innovation on 17 of 20 measures of work innovation in 1994 and 1997. We will discuss the results for the 1994 National Employer Survey in more detail to illustrate how the effects are practically meaningful.

The average export level for 1993 was 10.7%. A one standard deviation increase in export level is associated with a .25 higher index score, a 5.0% decrease in the probability of being in the Low Innovator category (which means increased innovation) and a 5.0% increase in the probability of being in the Medium Innovator category. It was associated with a 4.2% increase in the average percent of workers in teams, a 5.9% increase in the probability of experimenting with teams and a 3.0% increase in the probability of adopting teams. It was associated with a 10.2% increase in the average percent of workers in meetings, a 3.2% increase in the probability of experimenting with meetings and a 7.6% increase in the probability of adopting meetings.

The average increase in exports over the 1983-1993 period was 4.3%. A one standard deviation increase in exports over this period was associated with a .104 increase in the index score. It was associated with a 3.2% decrease in the probability of being in the Weak Innovator category (which means increased innovation) and a 3.6% increase in the probability of being in the Medium Innovator category. It was associated with a 3.5% increase in the average percent of

workers in teams, a 2.8% increase in the probability of experimenting with teams and a 2.4% increase in the probability of adopting teams. It was associated with a 5.3% increase in the average percent of workers in meetings, a 3.8% increase in the probability of experimenting with meetings and a 5.9% increase in the probability of adopting meetings.

The 1994 National Employer survey also has firm-level export data for the year 1993. Thus, we were able to estimate the impact of exports on work innovations in individual establishments by using the actual exports of these individual establishments themselves (rather than industry level exports) to predict the ten new work practice measures for individual establishments. The regression results are in the last column of Table 6. Establishment exports predicted establishment work innovation measures in eight of 10 regressions at the 95% level of confidence controlling for unionization and establishment size. The other two regressions were nearly significant at this level. At the firm level, high exports as a percent of the firm's 1993 sales powerfully predicted new work practice scores. High exports predicted a higher level of experimentation and adoption overall of teams and meetings, a higher overall score on the Index, a low probability of being a Weak Innovator (which means more innovation), and a higher probability for being a Medium Innovator and a Strong Innovator. They also predicted a higher average percent of workers in teams and meetings.

Why are the industry differences that are apparently predicted by some innovation theorists not salient? We cannot tell if this is the result of a lack of operation of industry networks or a similar operation of industry networks in different industries. This study cannot resolve these questions because it has not observed these social networks directly. Abrahamson

and Rosenkopf theorize that the structure of communication networks influences the order in which potential adopters receive information about an innovation and adopt it. Different theories of the bandwagon effect have assumed that all adopters experience the same bandwagon pressure to adopt an innovation. They question this assumption. (1996) Our data suggests that establishment information about industry imports and exports may change this bandwagon pressure. Multiple-industry holding companies and interlocking corporate directorates may also play a role. (See Useem 1984); Haunschild 1993) Moreover, there is a lot of evidence for spatial and regional effects. (Haunschild 1993) One recent study specifically found that urbanization and localization accounted for innovation firm behavior more than concentrations of similar businesses. (Harrison, Kelley, & Gant 1996) Consultants, schools, and the mass media may help spread innovations across industrial boundaries.

Conclusion

Many scholars have tried to sort out the incidence, diffusion and performance effects of high performance work practices in the nineties. Differences in defining, measuring, and sampling these practices have hampered this project. The diffusion of work innovations at the end of the nineties presents a far more sobering picture than some previous research studies, mass media coverage, and popular enthusiasm might otherwise indicate. We find that self-directed work teams have taken off as an experimental work innovation, but their adoption is rather modest. Their diffusion appears to have stalled. Work-related meetings have significantly higher incidence in both experimentation and adoption than self-directed work teams. Ironically, their diffusion also appears to have stalled. The combination of many high performance work practices into the

high performance workplace is clearly a negligible phenomenon affecting about 1% of establishments nation-wide and not rising significantly from 1994-1997. Industry group differences are not a compelling predictor of the incidence and diffusion work innovations on the face of it. Nevertheless, we did find that objective economic measures of environmental turbulence for industry groups, especially imports and exports, do predict measures of work innovations by establishments. Moreover, establishment level exports predict establishment level work innovations. This echoes the work of Piore & Sabel. (1984)

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