IN PURSUIT OF HIGH PERFORMANCE:
CASE STUDIES OF SMALL METALWORKING FIRMS
IN MASSACHUSETTS

by

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Submitted to the Department of Urban Studies and Planning
in Partial Fulfillment of
the Requirements of the Degree of

Master of City Planning

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ABSTRACT

This thesis documents and analyzes the experiences of three small metalworking
firms in Massachusetts which have implemented, or have attempted to
implement, various organizational innovations to enhance their competitiveness. These innovations include Total Quality Management, "Just-In-Time" delivery,
and work reorganization to maximize the contribution of individual employees
in problem-solving and production-related activities.

The ability of small firms to enhance their overall competitiveness is of
paramount concern to firm owners, employees, and the communities in which
they are located. This paper argues that if economic development practitioners
and policy makers are to have an effective role in assisting small firms, they must
have a sophisticated understanding of the obstacles and opportunities small
firms face in adopting innovative organizational practices.

Among the major findings are that: practices vary from firm to firm; sustained
third party assistance is essential; training is critical; and firms need to overcome
several barriers to innovation. However, despite the difficulties, these cases also
demonstrate that innovation results in obvious and direct improvements in firm
performance, job satisfaction and overall morale. Evidence from this study also
indicates that firms help to diffuse information on organizational innovation;
however, firms are predictably reluctant to share this information with
competitors due to a diminished rent expectation associated with relinquishing
information which they perceive as giving them a competitive advantage.

Among the recommended roles for public policy are: the promotion of best
practice, the development of customer-supplier linkages, a greater public role in
brokering information and assistance, and the development of regional solutions
to problems of worker dislocation resulting from organizational innovation.

Thesis Supervisor: Dr. Frank Levy
Title: Professor of Urban Studies and Planning
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I. INTRODUCTION

Small metalworking firms in Massachusetts are at a cross-roads. Increased international competition and fundamental shifts in the state, regional, and national economies are creating serious challenges for these firms which, in many ways, provide the foundation for manufacturing in the Commonwealth. The challenges these firms face are driving the need to develop and adopt new organizational strategies in order to maximize the probability of their long-term survival. These new strategies, however, are not developing in a vacuum. Over the last decade, there has been an emerging consensus that, in order for the U.S. to compete effectively in world markets while simultaneously maintaining and enhancing its standard of living it must make better use of its human resources through innovative workplace practices (Dertouzos, Lester, and Solow 1989; Marshall 1987; Walton, 1987). As Kochan and McKersie explain,

"To do so in a world of shortening product life cycles, intensified price competition, greater specialization in product markets, and rapid advances in technology requires human resource practices that support (1) development of a well-educated, highly motivated, and multiskilled workforce; (2) high levels of participation in problem solving and continuous improvement in productivity and quality; and (3) sustained labor-management cooperation (Kochan and McKersie 1992)."

A focus on human resources, it is generally believed, will allow firms to compete while improving the standard of living through a strategy of producing at ever-higher levels of value-added. With the focus on human resources at their core, proposals for fundamental organizational reform, largely distilled from best-practice examples of such U.S. firms as Xerox, GM Saturn, and Motorola, involve: (1) focusing on improving cost, quality, and delivery; (2) developing closer
linkages with customers and suppliers; (3) using technology for strategic advantage; (4) adopting less hierarchical and less compartmentalized forms of organization for greater flexibility; and (5) implementing human resource policies that promote continuous learning, teamwork, participation, and flexibility (Dertouzos, Lester, and Solow 1989).

A small number of Massachusetts firms are taking these proposals for reform to heart and are in the process of adopting a series of organizational innovations designed to enhance their competitive position through a more strategic use of their human resources. The majority of companies, however, are adhering to traditional organizational practices. While their survival seems precarious given the new terms of competition, even innovative firms face a series of challenges.

The ability of small firms to adapt to changing economic conditions and to enhance their overall competitiveness is of paramount concern to all stakeholders involved: the owners of the firms, their employees, and the communities in which they are located. In fact, the health and well-being of these firms have become central concerns to economic development practitioners and policy makers, at the local, state and national level who are concerned not only with the competitiveness of firms per se, but also with the standard of living enjoyed by the people who work in them. But what can and should economic development policy and practice do to enhance small firm competitiveness? Answering this question requires a sophisticated understanding of the obstacles and opportunities small firms face in adopting innovative organizational practices. Furthermore, investigation is needed to analyze the outcomes of workplace changes in small firms, both in terms of firm competitiveness and worker welfare. By understanding this, economic development policy makers and practitioners can better identify a set of strategic interventions which will assist
these firms in achieving high performance while maximizing worker welfare at the same time.¹

This thesis documents and analyzes the experiences of three small metalworking firms in the Commonwealth which have implemented, or have attempted to implement, various organizational innovations in an effort to enhance their competitiveness. It explores the following questions: What specifically sparked the introduction of the innovations? What sources were used to gain information on and assistance with organizational innovation? What barriers have the firms faced in trying to implement the innovations? What impact(s) have the organizational innovations had on firm performance and employee well-being? And, to what extent do innovative small firms play a role in diffusing information on innovative workplace practices?

The paper is organized as follows: the remainder of this introduction discusses why manufacturing in general and metalworking in particular are important to the economic health of the Commonwealth and, therefore, warrant examination; the next section summarizes the literature on organizational innovation within the context of a changing world economy and will look at the extent to which firms, large and small, are engaging in innovative workplace practices; the third section provides background on the methodology used in this research; the fourth section provides an introduction to the actual cases studied; the fifth section presents the findings and analysis of this research; the sixth section suggests a role for public policy in assisting small firms in adopting innovative workplace practices; and, the final section provides some concluding remarks.

¹Throughout this document, terms such as "worker welfare" and "worker well-being" are used to summarize such factors as satisfaction with wages, hours, and working conditions, as well as overall job satisfaction and job security.
Manufacturing and Metalworking in the Commonwealth

Why Manufacturing Matters

Since the 1960's, the Commonwealth has experienced a precipitous decline in manufacturing jobs. (See Figure 1.) From 1967 to 1977 employment in manufacturing declined 14 percent (from 713,600 to 615,000.) After a slight increase from 1977 to 1982, when 30,000 jobs were added, employment declined 23.7 percent to a total of 490,912 jobs, and the decline appears to be continuing (Cann, Forrant and McGraw 1992).

Figure 1

![Massachusetts Manufacturing Employment Levels 1967-1991](chart.png)


Few manufacturing sectors have been immune to the job losses. Over 30 percent of all jobs in Apparel, Electrical Equipment, Leather, Industrial Machinery, Furniture, Rubber and Textile sectors have been lost since 1982. While some industries made minimal gains, these gains equaled less than the
number of jobs lost in the Industrial Machinery sector alone (Cann, Forrant, and McGraw 1992).

Despite this decline, manufacturing remains fundamentally important to the Massachusetts economy and to the standard of living for many residents in the Commonwealth. While it makes up a relatively small percentage of total employment (estimates indicate it is now somewhere between 17 and 19 percent), it still provides much well-paid employment and supports many related service jobs. In fact, in many parts of the state, manufacturing employment continues to account for more than 1 in every 5 workers. This regional variation can be seen in county-by-county employment figures (see Figure 2).2

Figure 2

1989 County Employment in Manufacturing


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2 This chart includes ten out of the fourteen counties in the Commonwealth and accounts for 93% of total employment.
The 1980s witnessed a tremendous growth in Services, Construction and FIRE (Finance, Insurance, and Real Estate) industries. Some saw these industries as the new engine of growth for an economy traditionally reliant on manufacturing, while others questioned the ability of these industries to sustain the Commonwealth's economy (Browne 1991). While overall growth did mask the decline in manufacturing for a time, a look around the Commonwealth indicates that growth in other sectors of the economy has failed to compensate for losses in manufacturing on a regional basis in large part because this growth has occurred primarily in the Greater Boston area. This has left many Commonwealth communities with declining employment opportunities as a result.

**Why Metalworking Matters**

Metalworking has long been considered to be at the core of the Massachusetts manufacturing economy. In the nationwide 1987 Census of Manufacturers, selected manufacturing industry groups (of which metalworking is an important part) accounted for 43% of all employees and value-added in manufacturing in the country.3 Between 1982 and 1991, these same industry groups represented, on average, 58% of all manufacturing employment in the Commonwealth. SIC 35 (Industrial Machinery and Equipment), the industry group in manufacturing with the highest employment of all manufacturing groups, accounts for 16% of all manufacturing employment in the

---

3This figure includes the following SIC major groups: SIC 34-Fabricated Metal Products; SIC 35-Industrial Machinery and Equipment; SIC 36-Electronic and Other Electric Equipment; SIC 37-Transportation Equipment; and, SIC 38-Instruments and Related Products.
Commonwealth.⁴ (See Figure 3 for the distribution of manufacturing jobs across selected SIC codes.)

Figure 3

Manufacturing Jobs in MA by Selected SIC Codes 1982-1991 in 000s

<table>
<thead>
<tr>
<th>Year</th>
<th>SIC Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>20</td>
<td>Food</td>
</tr>
<tr>
<td>1982</td>
<td>22</td>
<td>Textiles</td>
</tr>
<tr>
<td>1982</td>
<td>23</td>
<td>Apparel</td>
</tr>
<tr>
<td>1982</td>
<td>27</td>
<td>Printing/Publishing</td>
</tr>
<tr>
<td>1982</td>
<td>30</td>
<td>Rubber</td>
</tr>
<tr>
<td>1982</td>
<td>31</td>
<td>Leather</td>
</tr>
<tr>
<td>1982</td>
<td>34</td>
<td>Fabricated Metal</td>
</tr>
<tr>
<td>1982</td>
<td>35</td>
<td>Industrial Machinery</td>
</tr>
<tr>
<td>1982</td>
<td>36</td>
<td>Electrical Equipment</td>
</tr>
<tr>
<td>1982</td>
<td>37</td>
<td>Transportation</td>
</tr>
<tr>
<td>1982</td>
<td>38</td>
<td>Instruments</td>
</tr>
</tbody>
</table>


The well-being of metalworking firms has been a cause for concern in the Commonwealth for quite some time. Many major customers have downsized or gone out of business resulting in declining business opportunities for the smaller supplier firms. For instance, in February of 1986, the United Technologies Diesel Systems plant (formerly American Bosch) in Springfield announced it would be closing, striking a major blow to the Commonwealth - particularly in the Western region. This was just one in a series of plant closings and layoffs which began in

the late 1970s, and, was a major contributing factor to the 15,000 metalworking jobs that were lost in a five year period in the Greater Springfield area alone.\textsuperscript{5}

As large plants downsized or closed altogether in the late 1970s and 80s, small and medium-sized metalworking firms began to take on a new importance in regional economies around the state. In fact, it was precisely during this period of massive downsizing and plant closings that many of these small firms were created, becoming an important source of well paying manufacturing jobs in the Commonwealth (Cann, Forrant, and McGraw 1992).\textsuperscript{6} The combination of large firm downsizing and small firm growth resulted in a drop in the average firm size from 1967-1991 of nearly 11 percent, from 55 to 49 workers (Cann, Forrant, and McGraw 1992).\textsuperscript{7} Today, smaller firms continue to play an important economic role in the Commonwealth.\textsuperscript{8}

The Current Economic Environment in Metalworking

Understanding what is happening in and to small metalworking firms requires knowledge of what is happening in the markets they serve. In a recent survey conducted by the Machine Action Project, located in Western

\textsuperscript{5}Obtained from the Machine Action Project in Springfield, MA.

\textsuperscript{6}While it is true that small firms continue to pay lower wages than larger firms, compared to other types of employment these jobs pay relatively well.

\textsuperscript{7}At first glance this number may not seem dramatic. However, it is important to emphasize that this statistic is an average, and as such is skewed by the fact that such a large number of firms in the Commonwealth and in the country (more than 90%) are small. The fact that the average firm size has dropped 11\% indicates drastic reductions in the number of people employed in large firms.

\textsuperscript{8}It is interesting to note that the closing of large plants and the massive layoffs which have occurred have created a skills problem for former employees of the larger employers seeking work with smaller firms. Because of the tradition of mass production in large manufacturing firms and the Tayloristic form of work organization that this implies, many of these dislocated workers have developed a very narrow set of skills appropriate to an individual piece of technology, and have a difficult time adjusting to the small firm environment where, even though elements of Tayloristic forms of work organization exist, workers tend to be deployed in different ways depending on the workload on any given day.
Massachusetts, metalworking firms were asked to identify their top five markets. Eighty-three percent of the respondents listed machine tools as a top market; seventy-eight percent listed the aerospace industry, including military and commercial; seventy-seven percent indicated defense; twenty-six percent listed computers and the electronics industry; and, twenty-two percent listed the medical industry (Cann, Forrant, and McGraw 1991).

Each of the above sectors, with the exception of the medical industry, has experienced severe problems over the last decade. The success of German and Japanese metalworking firms have drastically reduced the production of machine tools in this country. International competition had a particularly devastating effect on the Connecticut River Valley, once a world-renowned machine tool center, and has had a ripple effect on all New England metalworking companies who supply parts to that industry.

Recent and impending cuts in defense spending threaten those firms that rely most heavily on defense in the New England region. These cuts are expected to continue and there is, as yet, no national plan for converting defense dependent industries into non-military manufacturing activities. Thus, thousands of metalworking firms in the region are in danger of virtual extinction, unless they are able to diversify their product mix.

The high technology industry, once declared the panacea to the loss of manufacturing in the Commonwealth, has also experienced a serious downturn, limiting the ability of metalworking firms to either expand into or continue to operate in this industry, at least for now. One need only look at newspaper articles over the last two years to see the thousands of high technology jobs which have just recently been lost due to both the long-term restructuring of the industry which began in the 1970s and the current economic recession. A resurgence in this industry is possible, but appears to be at least a few years
away (Cann, Forrant, and McGraw 1991). The medical and health-related industries appear to show the most promise for providing future business to metalworking firms in the state. This is due in part to the aging of the population as well as to the concentration of medical research facilities and hospitals in the Northeast (Cann, Forrant, and McGraw 1991).

In addition to declining markets, each of the major customers within these industries have become much more demanding in their requirements for quality, price, flexibility, and service. International and national competition as well as exposure to Total Quality Management techniques imported from Japan have forced suppliers to adjust to ever-stringent customer demands such as "just-in-time" delivery of goods. This has forced many suppliers to adopt new technologies and organizational practices in an attempt to satisfy their customers' requirements. The more sophisticated of these firms are also realizing the benefits of implementing worker training and new forms of work organization as a means of maintaining and expanding their competitiveness.9

Customer requirements, put simply, are requiring suppliers to become more agile organizations. A 1989 Machine Action Project technology survey of machine shops in the Commonwealth indicated that close to 80% of the shops surveyed produce 60 or more distinct parts with batch sizes typically under 200 pieces. Anecdotal evidence suggests that suppliers today are being required to produce even more distinct parts at higher quality in batch sizes that total well under 100, and to do so at the 100-200 unit price.10

As difficult as the challenges are, there are some indicators that Massachusetts metalworking firms are positioned better than their counterparts across the country to be competitive in the ever-changing economic environment.

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10Interviews with firm owners, February 1993.
According to a recent survey by TECnet, small metalworking firms in Massachusetts have a relatively high level of technology adoption: "Seventy-seven percent of the respondents had at least one computer numerically-controlled (CNC) machine tool. Eighty percent used personal computers for various business and manufacturing functions. Nearly half also used computer-assisted drafting technology. And about a third used some form of statistical process control inspection. Finally, 58 percent of the respondents stated that they were planning to buy new technologies within the year (Schneider 1991)." The author of the TECnet study surmised that the small firms surveyed were "way ahead" of their counterparts in other parts of the country in technology acquisition.

There appear to be two contributing factors to this high acquisition rate: one is the change in the variety and nature of work that shops are performing, and the other is the influence of the Department of Defense and the Aerospace Industry on the region. These industries' exacting requirements have forced suppliers to update their technologies in attempt to improve product quality and reliability. On average, firms that list DOD or Aerospace as a major customer use 1.3 times more of the technologies than those who do not (Cann, Forrant, and McGraw 1991).

Although there is reason to be optimistic about the potential for Massachusetts to adapt to the current economic environment, there is also reason to be skeptical of their ability to adjust. For instance, the TECnet study identified that over half of those surveyed reported that the technologies that they do have are underutilized. The primary reasons for this were 1) while they knew what hardware to get, they did not know enough about software to know what would suit their needs, and 2) after purchasing the equipment they discovered that no one in the firm knew how to use it.
The TECnet survey also illuminated the fact that a significant number of metalworking firms exist in a very fragile environment. Some are dependent on a single customer, and more than 80 percent have no customers beyond New England, making them vulnerable to regional economic downturns, as these last two years have demonstrated.

Conclusion

Small metalworking firms face a difficult future in light of increased domestic and foreign competition, as well as cut-backs in many of the major domestic markets. From a technological standpoint, many Massachusetts firms are poised well to enter new and emerging markets. But diversifying one's customer base and enhancing one's overall competitiveness is increasingly coming to mean a willingness and ability to adopt flexible manufacturing practices in order to produce a more diversified product line in smaller batches and at higher quality, and to do so "just-in-time". This involves not only technology acquisition, but a commitment to upgrading workers' skills to more effectively utilize existing and evolving technologies. It also involves adopting new forms of work organization and other organizational innovations which allow workers to more effectively make a contribution to the firm's operations.
II. REVIEW OF THE LITERATURE

This chapter sets the broader context for considering the importance of manufacturing to the U.S. economy and the issue of organizational innovation in U.S. firms. Specifically, it speaks to the following issues: 1) Why, in general, does manufacturing matter?; 2) What dictates why manufacturing firms must change their traditional organizational practices?; 3) What do we know about how firms should change?; 4) What evidence is there that firms are changing, particularly small ones?; and, 5) Why should we worry about whether or not small firms are changing their organizational practices?

Why does manufacturing matter?

The introduction to this paper presented an argument for why we should be concerned about manufacturing in Massachusetts. But, what is the national context which helps us to understand why, as a whole, manufacturing is important?

Debate over the U.S.'s competitiveness as a nation almost always centers around concerns over U.S. manufacturing, particularly with regard to the declining superiority of American manufactured products in the international marketplace and the resulting erosion of the country's manufacturing base. While some argue that 1) the decline in manufacturing is a natural outcome of an economy in transition from a goods producing to a services producing society, and that 2) declining productivity growth (since World War II) is the result of a natural convergence process with the rest of the industrialized world (Baumol, Blackman, and Wolff 1989) others argue
that the erosion of the manufacturing base threatens the economic health of this country (Dertouzos, Lester, and Solow 1989). Specifically, this argument states that a large, continental economy such as the United States cannot function primarily as a producer of services in the foreseeable future. As such, it would have to rely on service exports to pay for its imports, and recent statistics indicate that this is not likely to be able to happen. According to the authors of Made in America, "In 1987 gross U.S. exports of services, excluding income from overseas investments and overseas sales of government services, were worth about $57 billion, whereas the total value of goods and services imported into the United States was about $550 billion" (Dertouzos, Lester, and Solow 1989).

**What dictates why manufacturing firms must change their traditional organizational practices?**

The simple answer to this is that traditional organizational practices are no longer resulting in strategic competitive advantage for the U.S. Traditional organizational practices are very deeply rooted in turn-of-the-century notions regarding what is the most efficient means for organizing production. Frederick Winslow Taylor, the master-mind behind the scientific management movement, devised a system whereby complicated jobs were broken down into a series of rote tasks so that anyone, regardless of education level, would be able to do the job. Decision-making was to be removed from workers; all knowledge of the job was to be embedded in the process. While the motive may have been one of wrestling control of the work process away from workers (as organized labor believed), the argument for such a system was that it would compensate for a largely unskilled pool of immigrant labor
incapable of performing the more complicated tasks on its own (Filippelli 1984).

Taylorism, in many ways, provided the basis for the system of mass-production which has flourished in the U.S. since the earlier part of the century.\(^{11}\) Indeed, academic researchers have attributed the rapid economic growth in industrialized economies such as the U.S., particularly from approximately 1945 to 1970, to the cumulative gains in productivity and growth in output inherent in a system based on mass production (Appelbaum and Batt 1993).

Evidence from the 1970s and 1980s indicates that this system of mass production has broken down, with devastating impacts on both firms and workers. Two important reasons are often cited for this: 1) the fact that newly industrialized countries and even less developed countries, both of which have much lower wages than in the U.S., have successfully adopted mass production technologies which have allowed them to compete in markets once dominated by the U.S., thus putting downward pressure on U.S. wages in traditional mass-producing industries, and hence, on the American standard of living itself; and, 2) the fact that other developed countries have increased their capacity for customization and diversity, thus reducing the cost advantages of mass production and increasing competition not on cost but on quality (Appelbaum and Batt 1993).

Piore and Sabel (1984) were among the first to articulate the fundamental shifts in international competition which are drastically

\(^{11}\) According to Appelbaum and Batt (1993), the system of mass-production relied on a set of interrelated characteristics: 1) dedicated technology, 2) Tayloristic work organization, 3) the sharing of performance gains between workers and firms, 4) consumption growth based on the rise of real wages, and 5) investment dynamics based on the accelerator and supported by the growth of internal cash flow, with improvements in technology embodied in later vintages of capital.
impacting the ways in which U.S. companies need to compete now and in the future. In their classic book, the Second Industrial Divide, they describe a world economy of intense competition where factors such as quality, highly differentiated products, and time to market, will determine what companies will survive and what companies will not. They argue that the American legacy of mass-producing standardized goods for homogeneous mass markets is ill-suited to the task of competing in the new economic environment where consumers are demanding higher value-added and differentiated products at superior quality (Piore and Sable 1984).

In 1990, a controversial and catalytic publication entitled, America’s Choice: high skills or low wages! popularized the notion that the U.S. can no longer compete using mass production technologies. In addition to arguing that the U.S. cannot compete on the basis of wages with lesser developed countries, this report goes on to discuss what changes in terms of skill levels and work organization must be made in the U.S. as a whole and in U.S. firms in particular in order for this country to compete not on wages, but on high quality, highly differentiated goods.

What do we know about how firms should change?

Various authors have discussed how they believe firms need to change in order to meet the challenges of the current economic environment. Bailey (1992) compiled a comprehensive list of terms currently being used in the literature to differentiate between outdated and innovative organizational forms. These include: mass versus flexible production (Piore and Sabel 1984), command and control versus participatory (Hayes, Wheelwright, and Clark 1989), conflict versus commitment (Walton 1985), industrial versus salaried
While a consensus has emerged regarding the need for firms to change their traditional organizational practices, there has been little agreement as to what specific changes ought to be made or what specific models ought to be adopted. However, a set of commonly agreed upon practices has emerged that, in various combinations, is providing positive outcomes for the firms engaging in them. These practices consist of some that have been around in the U.S. for quite some time and others which have more recently taken a foothold in the states. Appelbaum and Batt (1993) categorize these practices based on the overall systems from which they come. They are: the American Human Resource Model, Swedish Sociotechnical Systems, Japanese Lean Production, Italian Flexible Specialization and German Diversified Quality Production. (For a fuller discussion, see Appelbaum and Batt 1993.)

**The American Human Resource Model.** This model focuses largely on techniques to improve individual performance. These include techniques to improve job satisfaction such as job enlargement and enrichment, better communication, and employee involvement.

**The Swedish Sociotechnical Systems.** This approach, with its initial emphasis on the relationship between technology and workers, has come to include a strong emphasis on reorganizing production through the use of autonomous work teams as a way of both democratizing the workplace and making it more efficient by employing a decentralized and flexible organization of production.

**Japanese Lean Production.** This system is made up of practices which involve reducing impediments to the production process by facilitating changeovers, rationalizing plant layout, training workers in quality control practices (through Statistical Process Control-SPC), improving equipment maintenance, simplifying product design, and involving workers in problem solving activities. The practice referred to as "just-in-time" delivery also comes from this lean production model whereby
firms minimize inventories by requiring suppliers to deliver parts on an as-needed basis. Lean production, as a concept, was developed by applying quality management concepts developed by Deming, Juran, and Ishikawa - the gurus of what has popularly become known as Total Quality Management.

**Italian Flexible Specialization.** Flexible specialization emphasizes: 1) small scale production of a large variety of goods, 2) strong networks of small producers that achieve efficiency through specialization, and achieve flexibility through collaboration, 3) worker representation through strong unions, and 4) local governments that provide collective goods and services that reduce costs and encourage cooperation.

**German Diversified Quality Production.** This form of production involves high volume producers which combine the high, craft oriented skills of the workforce with technologies which help to diversify products as a way to "segment mass markets and gain market share in the high end of the market, where superior performance and customized design are able to command higher prices. Since workers' wages are paid out of value added, this high value added strategy allows firms in a high wage economy to remain competitive (Appelbaum and Batt 1993)."

While most agree that no single practice, standing alone, can be considered as indicative of a high performance work system, the above mentioned "systems" help to put in context the universe of practices, the combination of which can help to move a firm toward high performance.12

At the heart of most of these practices is the hypothesis that employee participation can play an important role in the competitiveness of firms.

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12Ultimately, the effectiveness of any combination of these practices can be evaluated based on criteria established by Bailey (1992) in his "Discretionary Effort" model. Bailey sees three basic requirements for effective work reform: 1) Motivation: because the point is to get people to increase their effort; 2) Skills: because the effectiveness of employee participation can be limited by the skill and knowledge levels of employees; and, 3) Organizational Structures: because employees must have the opportunity to make contributions to the organization. If jobs are rote and employees are never asked for their input on how the work could be done more efficiently, then the only discretionary effort an employee can offer is to work faster. Bailey goes on to identify numerous types of structures through which discretionary effort can be channeled; they include: work redesign, quality circles, autonomous work teams, labor-management committees, and cross-functional teams.
While there is no consensus that participation, per se, has a positive impact on productivity, a chorus of academic voices question the ability of traditional, firm-based performance measures such as return-on-investment and earnings-per-share to capture such things as quality, time-to-market, and responsiveness to customers, factors which many claim will determine the ability of a firm to compete in the international marketplace in the future.

Charles Perrow (1970) offers a more theoretical framework for thinking about whether or not participatory work schemes are appropriate in a firm by relating technology and the nature of a firm's tasks to the actual form of the organization (Bailey 1992). In his framework, he focuses on 1) task variability: the degree to which the task is routinized and has few exceptions; and, 2) methods for resolving uncertainty: the degree to which the changing nature of problems being posed requires developing new solutions versus being able to apply set methods for resolving problems.

Under this framework, where tasks do not vary much, where there are few exceptions, and where problems posed in the development or production process have known ways of being resolved, the traditional, routinized and centralized form of work organization is deemed to be most effective. In this type of situation, it is argued, little is to be gained from employee involvement schemes since the only discretionary effort to be elicited is working harder (where other incentives, such as financial ones, would be more appropriate.) However, where there is significant variation in the tasks to be performed, and where new solutions must be created to resolve new problems, a more flexible, participatory work scheme would be most appropriate.

While Perrow used this framework to argue that work reform was not the answer to all organizational problems, this model has also been used to
emphasize how the break-down of mass production and the changes in the international marketplace require participatory work schemes in most companies (Bailey 1992).

**What evidence is there that these types of practices are taking place in U.S. firms and, in particular, in small firms?**

Evidence that these types of practices are taking place in the U.S. is difficult to assess as a whole primarily because studies typically tend to focus on one type of practice or a limited set of practices at a time (such as total quality programs, training, employee involvement, or work reorganization.) Of the evidence that does exist, there is little to support the notion that organizational practices are clustering into any kind of new organizational model (Osterman 1993). However, by surveying the data that is available one can begin to develop a sense of the extent to which U.S. firms are, in general, adopting innovative practices.

Cutcher-Gershenfeld, Kochan and Verma summarized survey evidence available in 1985 on employee participation indicating that somewhere between one-third and one-half of U.S. firms had implemented some form of direct employee participation in the workplace (Cutcher-Gershenfeld, Kochan and Verma 1991).13 The authors also review evidence that indicates that, while many firms may adopt employee participation programs, many of these programs last no more than a few years. Their own case study evidence, taken from research conducted over a three-year period under the auspices of MIT's Industrial Relations Section with the support of the Department of Labor, indicates that employee participation efforts, when

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13The authors cite surveys commissioned by the New York Stock Exchange, Business Week, and the American Management Association, each of which indicated that approximately 35 to 50 percent of U.S. firms report the use of employee participation.
isolated from other organizational strategies, have little chance of surviving over time (Cutcher-Gershenfeld, Kochan and Verma 1991).14

In an even more recent review of the survey evidence, Appelbaum and Batt (1993) come to the conclusion that, "the proportion of firms with at least one employee involvement practice somewhere in the company is large and growing, and that a significant number of firms has begun to make more extensive use of these practices." Discussed below are a number of recent studies which shed light on the issue of how prevalent organizational innovation is in U.S. workplaces today, both in terms of employee involvement in particular and other workplace innovations in general. (See Appelbaum and Batt 1993 for a more detailed summary of the evidence.)

In a 1987 survey, in which 476 Fortune 1000 firms participated, it appeared that a total of one quarter of U.S. firms had made substantial changes in management, work organization, and human resource practices. But in these firms, not more than 20 percent of the workforce was affected (Lawler, Mohrman, and Ledford 1987). In a study conducted by the American Society for Training and Development, the author found that only 13 percent of firms were organized into high performance systems that "de-emphasize hierarchy and emphasize collaboration and teamwork (Carnevale 1992)." A 1992 International Quality Study (conducted by Ernst and Young and the American Quality Foundation) found that 49 percent of U.S. firms involve more than 25 percent of their workers in quality related teams. But only 16 percent report having more than 75 percent or more participating in quality meetings.

Osterman (1993), in a random sample of establishments from the Dun and Bradstreet establishment file, found that about 35 percent of private sector

14The MIT study included such notable firms as Xerox, General Motors, Boeing and Goodyear.
firms with 50 or more employees have achieved substantial use of what he called flexible work organization.\textsuperscript{15} In identifying firms deemed to have flexible work organization, Osterman looked for firms which involved at least 50 percent of their workforces in at least 2 out of the four workplace practices in which he was interested.\textsuperscript{16} 

Bassi (1992), in an attempt to fill a gap in the literature, conducted a study of small and medium sized firms (under 500 employees) and the extent to which they have adopted practices associated with high performance forms of work organization. She found that 33.7-51.5 percent of non-manufacturing firms and 50.7-76.8 percent of manufacturing firms have undergone at least some reorganization of work (as defined by engaging in one of a number of different practices, including work teams/quality circles, empowerment, TQM, statistical process control, and just-in-time or computer integrated production.)\textsuperscript{17} However, only a tiny fraction have undergone substantial numbers of reorganizational changes (i.e. have implemented all of the listed forms of work organization.) As for workforce training, 5.6-8.5 percent of nonmanufacturing firms and 7.6-11.6 percent of manufacturing firms reported a workplace education program. But again, only a small fraction actually have a substantial program in place. In addition, the evidence indicates that firms which have not pursued organizational innovations (or have only pursued a moderate amount) tend to be smaller than those that have implemented a substantial number of innovations.

\textsuperscript{15} The response rate in the Osterman study was unusually high at 65.6 percent. 
\textsuperscript{16} In his survey, Osterman asked about the following four indicators of flexible work organization: 1) self-directed work teams, 2) job rotation, 3) use of employee problem solving groups or quality circles, and 4) the use of TQM. 
\textsuperscript{17} The response rate in the Bassi study was relatively low - 18 percent from the National Association of Manufacturing’s mailing list and 7 percent from the lists of a professional mail house.
Appelbaum and Batt (1993) point out that, in many of these types of studies, there exist certain biases that may affect the validity of the results. First, they note that firms which have introduced new practices are more likely to respond to the surveys than those which have not. Second, the vast majority of surveys interview executives and managers, who, particularly if they are directly responsible for implementing the practices, may present a skewed picture of the extent to which practices have actually been implemented. Finally, students of the workplace may find the thresholds for organizational innovation rather low in determining whether or not a particular workplace has innovated in a substantial and meaningful way. Thus the number of innovative firms which are deemed to exist may be overstated. For those who believe that adopting high performance forms of work organization is critical to the U.S.'s competitiveness and to the American standard of living, the number of firms which are making substantial strides in this direction appears to be disturbingly small.

**Why should we care about whether or not small firms adopt these changes?**

There are two main reasons we need to be concerned about whether or not small firms adopt these changes: first, because they play an important role in the national economy, and second, because available evidence suggests they are the least likely to adopt organizational innovation.

According to the U.S. Small Business Association (1988), there are approximately 355,000 small and midsized manufacturing enterprises (defined as firms employing fewer than 500 workers) in the U.S. that employ more than 8 million workers. These companies produce more than one-half of value-added in manufacturing, and, as such, form a critical part of the U.S.
industrial base. Because many of these smaller firms supply larger firms, their ability (or lack thereof) to produce at world class standards affects the performance of the industrial base as a whole (Shapira 1990).

In addition, the available evidence suggests that small firms in the U.S. have experienced a great deal of trouble in modernizing their operations, both from a technological and an organizational point of view. Study after study in the last decade have demonstrated that small firms lag behind their larger counterparts in technology adoption (Rees, Briggs, and Oakey 1984; ITI 1987; Kelley and Brooks 1988; U.S. Department of Commerce 1989), organizational innovation - sometimes referred to as "soft" technology (Shapira and Geiger 1990; Bassi 1992), and worker training (Shapira and Geiger 1990, Osterman 1989). (See Shapira 1990 for a discussion of many of these studies.)

But this notion that small firms lack the ability to innovate runs counter to much of the accepted wisdom that small business is a major source of job growth and innovation (Birch 1979, Acs 1988, and Acs and Audretsch 1990). What accounts for this dichotomy? Several sources (listed above) point to small firms as significant job generators in this country as well as major sources of innovation. But if one looks at studies on innovation in small firms, one learns that innovation, in large part, is measured in terms of the numbers of patents attributed to a particular firm in a given time period. However, most small firms in this country are not in the business of patenting their own products; rather they are suppliers to original equipment manufacturers (OEMs). It is within the supplier firm population where much of the concern lies; indeed U.S. firms, in particular the small ones, still excel in the development of new products, but lag behind other countries in
terms of improving the organizational processes which facilitate the production of high quality goods.

With this distinction in mind, much of the literature (except for one notable exception—Osterman 1993) asserts that the diffusion of organizational practices appears to be much slower in small and medium sized (read supplier) firms than in large firms. This has been attributed to a number of different factors including isolation from the marketplace, financial and time constraints, lack of a highly skilled and well trained work-force, fear of change, and lack of technical expertise or general awareness about best practices (Shapira 1990; Flynn 1993, forthcoming; and NIST 1992). One recent study found that international competition, which is driving much of the innovation in large firms, is not perceived to be as important a concern to small business executives as it is to large business executives (Taylor and Banks 1992), something which may explain part of the lack of organizational innovation or awareness of innovative practices on the part of small firms.
III. METHODOLOGY

As was stated at the outset of this paper, the purpose of this research is to document and analyze the experiences of small metalworking firms in Massachusetts that are attempting to implement and sustain innovative workplace practices in order to achieve high performance. Of particular interest is why these firms decided to pursue innovation, where they received their information and how willing they are to share it, what the innovations consisted of, what the process of innovation has been like, and what outcomes have been observed. Given that most of the research on innovative workplace practices has been done in large, primarily union firms, this research was designed to contribute to the existing literature by shedding light on how these issues play out in a small, non-union environment and in firms which, in many respects, provide the base for manufacturing in the Commonwealth of Massachusetts if not the country. In addition, while most studies solicit the thoughts of CEOs and supervisors, this study incorporated the views of people in all levels of the organization, from the firm owner to the front-line worker.

A case study methodology was chosen because, while it may limit the generalizability of the results, it has the greatest chance of capturing the nuances and intricacies of what is a very complex and unexplored subject, namely how small firms decide to pursue organizational innovation and how they deal with the implementation process.

In this section I define a series of terms which are used in this paper. I also discuss the process by which the case studies were selected and detail the types of information which were obtained from the participating firms.
Defining Terms

There are a number of terms which I use throughout this paper which require some clarification. First of all, I use the term high performance work organization to describe an organization which successfully integrates the use of technology, work organization, and worker capabilities to 1) maximize firm performance (through a heightened responsiveness to market demands), 2) increase organizational flexibility, and 3) empower workers. (See Marshall and Tucker 1992; Commission on the Skills of the American Workforce 1990; and Flynn 1993, forthcoming.) Other terms which are roughly similar in nature are high performance work systems (Appelbaum and Batt 1992) and flexible work organization (Osterman 1993). Rather than fixate on the differing nuances among these terms, I choose in this paper to use them interchangeably.

In addition, I use the terms organizational innovation and innovative workplace practices to describe those workplace practices which are a substantial departure from the firms' traditional way of doing business and which move firms in the direction of high performance work organization. Many authors have offered their own sets of practices which they consider to be organizational innovation (for examples, see Osterman 1992, Bassi 1992, Block et al 1990.) To operationalize this concept for the purposes of this paper, I have laid out those practices which are commonly referred to in the literature as contributing to the making of high performance work organization. These include: 1) information sharing about the business with employees, 2) employee involvement, 3) Total Quality Management efforts such as statistical process control (SPC), 4) "Just-In-Time" delivery, 5) cooperative working relationships with customers and suppliers, 6) new
forms of work organization, such as autonomous work teams and work cells (often referred to as cellular manufacturing in the manufacturing context), 7) effective use of technology, and 8) worker training initiatives.

Firm Selection Criteria

Firm selection criteria was based on the following concerns: the need to have sufficient similarity across the firms so that they could be considered, in many ways, comparable; and, the need to allow for some variation across the firms to see if this variation is important in any way. The selection criteria included: 1) under 100 employees, 2) sales under $10 million, 3) all supplier firms within the metalworking field, 4) non-union, 5) located in Massachusetts, 6) serving a variety of industries, and 7) a range of innovations, but which fit criteria associated with high performance work organization.

The Process of Site Selection

Locating small metalworking firms which have innovated or are innovating in the ways described above turned out to be a difficult task. While technology acquisition rates tend to be high in Massachusetts firms (as indicated in the TECnet study), one recent study estimates that only about 10-15 percent of metalworking firms in the Commonwealth have implemented substantial organizational innovations.18 Given this reality, I enlisted the cooperation of a number of individuals with first-hand knowledge of cases of innovation. These included:

18Interview with Bob Forrant, Director of the Machine Action Project in Springfield, MA.
1) The Executive Director of the Western Chapter of the National Tooling and Machining Association (NTMA);

2) The Director of the Bay State Center for Applied Technology, a publicly supported economic development program designed to provide technical assistance to small and medium size firms throughout the Commonwealth;

3) The Director of Technologies for Effective Cooperation Network (TECnet), a public/private service center whose mission is to stimulate the development of production networks in Massachusetts; and,

4) Firm owners who were familiar with firms that were implementing substantial innovations in their workplace practices.

Three firms were selected to participate in the research. The sites were:

**Brimfield Precision, Inc.**

- Number of Employees: 85
- Annual Sales: $5-8 million
- Location: Brimfield, Massachusetts
- Year Founded: 1967
- Primary Business: Surgical Appliances and Supplies
- SIC Code: 3842
- Selected Innovations: Total Quality Management (including statistical process control - SPC); "Just-In-Time" delivery; training; establishment of small business units (SBUs); cellular manufacturing; autonomous work teams; development of innovative pay scheme; information sharing.

**Lemco Miller, Inc.**

- Number of Employees: 30
- Annual Sales: Approximately $2 million
- Location: Danvers, Massachusetts
- Year Founded: 1978
- Primary Business: Contract Machine Shop
- SIC Code: 3599
**Burgess Brothers, Inc.**

- **Number of Employees:** 60
- **Annual Sales:** $5-8 million
- **Location:** Canton, Massachusetts
- **Year Founded:** 1948
- **Primary Business:** Custom Production Machining and Sheet Metal Fabrication
- **SIC Code:** 3599 and 3444
- **Selected Innovations:** Partial Implementation of TQM philosophy; information sharing; training; movement toward team-based production and problem-solving.

**Interview Methodology**

Thirty interviews were conducted over a two-month period with firm owners, managers, and front-line workers. The purpose of these interviews was to gather their opinions on and insights into why innovations were adopted, how they were implemented over time, and what results have been achieved. Described below are the types of questions I posed to the interviewees.

**Firm Owners:** What has been the impetus for the organizational changes you have made? What types of changes have you implemented or attempted to implement in your company? What barriers, if any, have you experienced (both in terms of the implementation process and in terms of your firm's ability to reap the
benefits of the changes)? What results, if any, has your company experience as a result of the organizational innovations?

Managers: What is your sense of why your firm has moved to adopt organizational innovations? What was your role in terms of the decision to adopt these innovations and in terms of the implementation process? How have these changes affected your job as a manager? What was the biggest challenge you have faced in terms of implementing the innovations? What results have you witnessed?

Front-Line Workers: Have the organizational innovations which have been implemented affected you and your job? In what way(s)? What was your role in implementing the innovations? What is your opinion of the changes that have gone on in the firm? What barriers do you think stand in the way of reaping benefits from the changes?

From these interviews, I assessed why these firms implemented the innovations, how this strategy was accepted by front-line workers and managers, what barriers and opportunities arose in the course of implementing the innovations, and what outcomes are apparent so far in the process. In analyzing "outcomes," I consider both company outcomes (such as an increase in quality or profits) as well as outcomes affecting employees such as impacts on job satisfaction, worker autonomy, and worker skills.
IV. BACKGROUND INFORMATION ON THE CASE STUDIES

An Introduction to the Cases

This section of the paper provides an introduction to the firms studied. Throughout these summaries there is an attempt to include a complete picture of the firms themselves and their efforts at organizational innovation. For each company, the following pieces of information are included:

A) A description of the firm, including its primary business;
B) The forces driving change in organizational practices;
C) The nature of the innovative organizational practices; and,
D) Some concluding remarks
The Firm and its Business

Brimfield Precision, Inc., located in Brimfield, Massachusetts, was founded in 1967 and is a supplier to the medical industry. Brimfield is a high precision manufacturer of medical implants, general instrumentation (including stapling instruments,) and instrumentation designed for use in minimally invasive surgery. It has capabilities in design engineering, prototype and production CNC machining, electron beam welding, laser marking, polishing, and electro-mechanical assembly. The company is located in two main buildings on a rural site, the original building and a new, much larger addition.

As part of its effort to become a more customer oriented business, Brimfield Precision recently reorganized itself into four small business units: 1) Implantable Products, 2) General Instrumentation, 3) Minimally Invasive Surgery, and 4) General Services. The firm currently has 85 employees, 74 of whom work in the various production units (including three unit supervisors,) and 11 of whom work in General Services which includes top management and support staff.

Approximately 20 percent of Brimfield's business is in Massachusetts, 50 percent is in New England, and the other 50 percent is outside of the region (80 percent of which is in Florida.) The company's sales peaked in 1990 at $8 million, but the current recession has taken its toll on the firm. Sales for the last two years have been flat at approximately $5.5 million. As difficult as these last two years have been for the company, the firm president is
optimistic about the future, hoping to build the company into a $10 million business by 1996.

The Forces Driving Change and Innovation

There are several factors that appear to have driven organizational change and innovation at Brimfield. These factors can be categorized as follows: Characteristics of the Company President, External/Environmental Factors, and Internal/Firm-Based Factors.

The current president of Brimfield, Bill Lyons, is the oldest son of the founder of the firm. He is an energetic, forward thinking person who very much personifies the "next generation" type of leader often referred to in the popular press. Faced with the decision to run the business as his father had or try something different, he decided to make his own mark on the firm. It was in 1991, after having been company president for four years, Lyons became intrigued with the Deming philosophy and the potential it held for his firm. Open to change, this initial exploration into Deming via a tape series from MIT turned out to be the first significant step on what would become the company's journey toward substantial organizational innovation.

A driving force in Lyons' openness to organizational change and innovation was the recognition that, while the company's external quality record was exemplary, its internal scrap and rework rates were extremely high, costing the firm untold losses in profits. These firm-based quality problems provided a significant impetus to implement organizational innovations.

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19Edward Deming is, in many ways, the founding father of the Total Quality Management movement, particularly with regard to that aspect of the movement which has to do with the application of statistical techniques to in-process quality control.
Another factor which solidified his desire to innovate was an eight-day period in 1991 when the firm lost a total of 45 percent of its business because of the failure for some of Brimfield's larger customers to reorder when they were scheduled to do so. This forced the company to begin to seriously consider how to become "lean and mean", and, with time on their hands from lost production, the opportunity to reevaluate the way they did business.

External/environmental factors also appear to have had an impact on the decision to innovate. Economic restructuring in Massachusetts and New England was causing (and continues to cause) a precipitous decline in the defense and aerospace industries. As the market in defense and aerospace began to shrink, Brimfield realized that many other small metalworking firms would be searching for new market opportunities and would look to the medical industry for business. "We can hear their footsteps," says management at Brimfield. The looming threat of future competition convinced the company that it needed to enhance its competitive position in the medical industry before others began entering the field.

Discussion on Innovations

The number of organizational innovations which have taken place at Brimfield, and continue to take place, are extensive. The company has embarked on a Total Quality Management trajectory, which has included training and the implementation of statistical process control. As part of the TQM implementation process, the company established what it calls "Deming Meetings" which were held twice a month on company time to share information on the business with employees and provide a forum for
educating people on the essential elements of TQM. In addition, teams were formed at these meetings to work on various problem-solving efforts, the results of which were reported at these meetings. The meetings are still held today, but less frequently -- more on an as-needed basis. The firm has also implemented "Just-In-Time" delivery and is continually modernizing its computer and technological capabilities.

As mentioned above, the company reorganized into four customer-focused business units, a significant departure from the way in which the company was organized previously (the production process was compartmentalized into various departments such as R&D, engineering, quality control, CNC machining, and assembly.) Now each individual business unit consists of all of these functions, with each employee a "stone's throw" from others with very different jobs in the production chain. The company has adopted a cellular manufacturing system where workers are organized into work cells and cross-trained to facilitate a smooth flow of work-in-process. With the implementation of SPC, the formerly centralized quality control department was completely disbanded (it now serves as an all-purpose tool bin) and the quality personnel have been integrated into the various business units as "quality coordinators" whose responsibility it is to assist their business units with in-process quality inspection.

The creation of business units and the physical reorientation of the plant has been combined with a move to a team-based system of production. On one level, the business unit is a team within the organization, meeting periodically to discuss production issues within the unit and to set production goals, among other tasks. In addition, each business unit decided on a team system within the unit. These teams consist of somewhere between 5-8 employees and are, in some cases, customer-focused and, in other cases,
production process-focused. These teams meet to discuss more micro
production problems and work together as a team to get the work done.

Brimfield recognized that reorganizing the company and empowering
workers would require changes in the incentive systems within the firm.
The company established an eight-person compensation committee to
research and recommend a new compensation system which would be
consistent with the organizational innovations. While it is not yet in place,
its elements have been outlined by the committee and have been agreed to by
management. They include the following: 1) pay for knowledge, 2) pay for
performance (as determined by team members), 3) pay for team performance
(as determined by customer satisfaction), and 4) profit sharing. The plan is
expected to be fully implemented within a few years.

Concluding Remarks

While the firm as a whole appears to be moving aggressively toward
high performance work organization, success in implementing these
innovations has been a bit uneven across the business units. Some of the
teams are working better than others and quality is better in some units then
others. Generally speaking, the firm has moved from a hierarchical decision-
making structure to a more decentralized, team-based process. Employees are
formerly participating in production scheduling and other business oriented
tasks and, in a number of cases becoming cross-trained in several different
areas. Many workers appear to be highly motivated and positive about the
changes in the firm and in their work; however, morale overall appears to be
low largely because wages have been stagnant over the last two years. In
terms of performance, some of Brimfield's managers have seen a reduction
in scrap rates; however, the firm is currently experiencing a problem with quality as evidenced by shipments to customers being sent back because of defective parts. Brimfield management sees this as the painful reality of moving to an in-process quality inspection system when employees appear both unwilling and, perhaps, unable (due to insufficient training) to take more responsibility for their work. Managers and employees alike seem to believe that the product rejections had to take place in order to get people to take more responsibility for quality in their teams and in their business units in general. Most everyone in the firm believe the changes can help to make the firm more profitable, but they also realize that it will not happen over night. Management, for instance, indicated that they believed they were two and a half years into what is probably a five-year process.
The Firm and its Business

Founded in 1978 as Lemco, Inc., Lemco Miller is a contract machine shop located in Danvers, Massachusetts. It was bought by its current owner, Dave Miller, in 1989. The company manufactures a variety of low and high tolerance parts, including set assembly parts, which eventually serve the medical, defense, aerospace, computer, electronic, machine tool, and printing industries. The vast majority of the firm's business (86 percent) is in Massachusetts, while a total of 98 percent of the business is in New England. Just 2 percent of the firm's business is outside of the region.

Lemco Miller is housed in a rather tight space in a multi-company building which is located in an industrial park setting. It has 30 employees, 22 of whom are on the shop floor. The rest include the plant manager, the sales representative, technicians, and front office staff. The company has just recently added a second shift to the company's operations.

Shortly after Miller bought the company, the economic recession hit the New England economy. The company currently has annual sales of approximately $2 million dollars, and is very concerned about its future. Many of the plans for expansion and modernization which Miller had when he first bought the company have been put on hold as the company has been forced into more of a survival strategy.
The Forces Driving Change and Innovation

In addition to the recession, changing customer requirements is the primary force driving change at Lemco Miller. Largely because many of the company's customers have moved toward a Just-In-Time approach to managing their inventories, Lemco has been forced into producing products in much smaller batches than was the case previously, creating many challenges for the firm. For instance, in 1989 the company was producing approximately 200 different parts. Today, the company is producing the same volume of work but is now making 545 parts. This has caused great increases in paperwork and serious costs associated with having to increase the number of set-ups required to produce the necessary parts. At the same time that its customers are requiring smaller batches, which are much more expensive to produce because of set-up costs, they are unwilling to pay more for the products, forcing the company to think about ways to reduce costs without compromising quality.

Discussion on Innovations

The first major innovation to take place at Lemco Miller was a technological one: the introduction of computerized hardware and software to manage the company's estimating and production scheduling. This turned out to be rather fortuitous, as, according Miller and his plant manager, the company would not have been able to survive the changes in customer requirements had it not been for moving from a manual to a computerized system.
The need to reduce set-up costs drove much of the rest of the organizational innovations. In the last two years, with the assistance of the Bay State Center for Applied Technology, the company has worked with two different consultants to help facilitate this effort. During this most recent go-around with a consultant, Lemco Miller has moved toward adopting a team oriented approach to production and problem-solving. The consultant facilitated off-site meetings once a month with employees to problem-solve around the issue of set-up times. This led to further innovations in the area of team work: now the most cohesive of the teams which formed out of this effort has taken on the task, with the coordination of a lead hand, of production scheduling within their area, a task formerly handled by the plant manager. Miller has plans to expand this "experimental" teaming effort to other parts of the company. So far, these teaming/problem solving efforts have resulted in identifying problems in shop organization and equipment, and have resulted in solutions which are contributing to set-up reductions.

During the same period of time that Lemco Miller pursued its teaming efforts to reduce set-up costs, the owner and his plant manager attended a TQM seminar at the local community college to learn about TQM philosophy and to think about how it could be applied to Lemco Miller. Upon returning to the shop, management attempted to implement some of the philosophy and practices associated with TQM, including increased business information sharing, performance charting, and a focus on the customer and quality. While the company has a traditional quality department, and efforts to implement SPC are a long way off, some of the company's cross-training efforts have involved rotating employees through the quality department so that they could learn about quality requirements. The idea was to expose
employees to quality requirements so that they can pay better attention to quality during the production process.

In addition to the teaming efforts, Lemco Miller has been involved with some training of its employees. For instance, the company recently sponsored employee training on CNC machine software. The training lasted four weeks and consisted of two hours a week of training on Saturday afternoons, during which time the company had to pay overtime to its employees.

**Concluding Remarks**

Lemco Miller's efforts to innovate, both technologically and organizationally, have been rocky. There is a genuine awareness of the external pressures driving the need to change, but there is also a very real frustration over the lack of resources needed to implement sustainable innovations. The owner and the plant manager both appear to be predisposed to the concepts underlying the TQM philosophy, but there also appears to be a lack of time, skill, know-how, and perseverance when it comes to implementing the necessary changes. The teaming efforts have been met with some success: the teams were able to generate several problem-solving ideas which have led to a partial reduction in set-up times and other production problems. While several employees involved in the teaming efforts appear positive about the changes which have taken place, morale appears to be low due primarily due to stagnating wages and periodic reductions in hours. Lemco Miller hopes to continue its efforts to become a high performance company, but the current economic climate seems to indicate that this will continue to be an uphill battle for the company.
CASE SUMMARY:
BURGESS BROTHERS, INC.

The Firm and Its Business

Burgess Brothers, founded in 1948, is located in Canton, Massachusetts. The company is housed in a sprawling warehouse-like building which appears able to house a company twice its size. There are two divisions within the company: a sheet metal shop and a machine shop. It has design and engineering capabilities and produces a wide variety of products for the medical, defense, and high technology electronics industries.

About 70 percent of the company's business is in Massachusetts, 20 percent is in Connecticut, and the rest is spread out among Rhode Island, New York, New Jersey, Missouri, and New Hampshire (although sales to New Hampshire have declined sharply over the last few years because of severe economic conditions in that state.)

Burgess Brothers has a total of 60 employees. The organizational structure consists of three partners, including the president; design, engineering, accounting and support staff; a Director of Manufacturing and two foremen, one in the machine shop and one in the sheet metal shop; and 25 hourly workers in the machine shop and 20 hourly workers in the sheet metal shop. The company has annual sales of about $5-6 million dollars and is looking to become a $10 million dollar business in the next few years.
The Forces Driving Change and Innovation

Changing customer requirements is the primary force driving change and innovation at Burgess Brothers. The year 1990 was a pivotal year for the company in terms of deciding to rethink the way they did business. Their customers were changing: in some cases, their customers were being bought out by foreign, primarily German, companies. In all cases, quality and delivery requirements were changing rather radically. Because its customers were adopting "Just-In-Time" delivery, Burgess Brothers was having to produce in much smaller batches than was previously the case. In addition, several of Burgess' customers were dispensing with incoming parts inspection, requiring their suppliers to be able to ensure quality in ways which were not required in the past. Finally, some of Burgess' customers began to require that their suppliers apply for the Malcolm Baldrige Award\textsuperscript{20} and ISO 9000 certification\textsuperscript{21}, providing added incentive to implement organizational innovations within the firm.

Discussion on Innovations

The innovations which have been implemented at Burgess Brothers are all considered to be part of a larger effort at becoming what the firm calls a

\textsuperscript{20}The Malcolm Baldrige National Quality award, named for the late Secretary of Commerce Malcolm Baldrige, was established in 1987 to recognize companies that have successfully implemented Total Quality Management systems. It is the U.S. equivalent to the Japanese Deming Prize, established in 1951.

\textsuperscript{21}ISO 9000 is an internationally recognized certification program designed to bring the harmonization of quality standards on an international scale. It includes a set of five individual but interrelated standards on quality management and quality assurance developed to help companies effectively document the quality system elements necessary to maintain an efficient quality system. Primarily intended to be used through normal buyer-seller relationships, it makes the production process transparent to potential customers through the documentation of the internal processes involved in producing a good.
"World Class Manufacturer." This has entailed adopting Just-In-Time, Total Quality Management (including statistical process control), cellular manufacturing, team problem-solving, and training.

When one walks into the machine shop and sheet metal shop, one is greeted with signs saying, "Zero defects is an attitude," and "Zero defect + JIT = Customers." As the later quote reflects, Burgess is attempting to marry the concepts of quality and Just-In-Time as part of their overall World Class Manufacturing program. The company is both supplying parts to its customers according to the JIT theory (and minimizing set-up times as an important way of accomplishing this) and is requiring JIT delivery on the part of its suppliers. While the company maintains a fairly traditional quality department (and appears to have no plans for eliminating it), the primary responsibility for quality has become that of the machine operators, most of whom conduct statistical process control on a regular basis.

Burgess is in the process of implementing a cellular approach to manufacturing. Currently, within each of its two shops, equipment is organized along traditional factory lines - by function. The Director of Manufacturing is currently working with the foremen and employees on designing a new shop floor layout based on cellular manufacturing principles. For instance, in the machine shop, Burgess will have four to five cells, each with a milling machine, a lathe, a drill press and a deburring machine. There will be two people in each cell and three floaters to be flexibly deployed on an as-needed basis.

Burgess Brothers has organized a number of customer-focused teams made up of representatives from each work area to problem-solve primarily in the area of set-up reduction time on those jobs which are run multiple times in the shop within a given year. In addition, production teams are
encouraged to keep track of production problems which occur in the course of a given day on flip charts located around the facility. At the end of each day, the teams gather around the flip charts and begin to problem-solve around the issues identified that day.

From the outset, Burgess Brothers implemented two 16-week training programs in both Just-In-Time philosophy and statistical process control. The training programs, which started out as voluntary, have become mandatory for all employees. The trainer is the company's Quality Assurance Manager who was trained by a consultant to conduct the 16-week programs. These programs appear to be very broad in nature. They: 1) provide an overall context for why traditional manufacturing approaches are no longer working, 2) introduce workers to the technical tools available to them in implementing JIT and SPC, and 3) assist workers in moving toward a team-based, problem-solving work environment. While there was some resistance in the beginning to the training, management believes that employees are starting to enjoy it because they see the results that existing teams have been able to achieve as a result of the training.

Concluding Remarks

Burgess Brothers is clearly proud of what it has been able to achieve. A few years ago, the company was in a serious financial crisis and attempted to do something radical to turn the situation around. While the company has spent a considerable amount of money on an outside consultant who has helped to facilitate the organizational transition, the firm owner believes that within a six month period, the consultant paid for himself by having helped the company to reduce substantial costs in the areas of set-up times and
quality. In addition, the company is beginning to reap the benefits of its new marketing effort designed to demonstrate its World Class Manufacturing status.
V. FINDINGS AND ANALYSIS

This paper explores why small firms decide to pursue organizational innovation, how issues surrounding the implementation process play out in a small firm environment, and what outcomes result from having attempted to innovate in work organization, quality, and various human resource practices. This section of the paper discusses and analyzes the findings of the case study research conducted in Brimfield Precision, Inc., Lemco Miller, Inc., and Burgess Brothers, Inc. The findings fall into four main areas: 1) The Decision to Pursue Organizational Innovation, 2) The Implementation Process, 3) Outcomes, and 4) The Role of Small Firms in Diffusing Information on Organizational Innovation.

THE DECISION TO PURSUE ORGANIZATIONAL INNOVATION

A survey of the management literature suggests that there are a number of different reasons why, in general, firm leadership may decide to strategically reorient a company. For instance, Lant, Milliken, and Batra (1992), in an empirical exploration into the role of managerial learning and interpretation in strategic persistence and reorientation, found that poor past performance, environmental awareness, top management team heterogeneity, and CEO turnover are each important factors which may increase the likelihood of reorientation (Lant, Milliken, and Batra 1992).22

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22 "Strategic persistence and reorientation" refers to a company's decision to continue with its current firm strategy, or to change company strategy. "Environmental awareness" refers to the extent to which a company is aware of changes in such factors as the competitive environment, product markets, or the industry in which the firm operates.
Osterman (1993) explored the question of why firms choose to reorient themselves via the adoption of such practices as self-directed work teams, job rotation, employee problem solving groups and Total Quality Management. He found that there is a correlation between the pursuit of high performance work systems (as characterized by various combinations of the above set of practices) with being in an internationally competitive product market, having a technology which requires high levels of skill, and following what is sometimes referred to as a "high road" strategy which focuses on variety and quality in contrast to cost (Osterman 1993). Osterman also found that employer values play an important role in determining whether or not an establishment engages in work reorganization efforts, a key organizational innovation.

In the three cases studied, it appears that increased environmental awareness (such as awareness of changing customer requirements and international competition), poor performance, CEO turnover, and managerial values played an important but varying role in each of the companies' decisions to reorient. Some of these factors are very much connected. For example, while Lemco Miller, Burgess Brothers, and Brimfield Precision have all enjoyed exceptional reputations in their field, each experienced its own performance crises in and around 1990 which created incentives to pursue innovation. These crises were largely related to changes in the external environment (e.g., changing customer requirements and loss of business); thus, poor past performance and increased environmental awareness are closely intertwined, as the discussion below will reflect.
A change in customer requirements was the root cause of problems at Lemco Miller. Customers who typically ordered in bulk were suddenly adopting "Just-In-Time" inventory control. This was manifested in the ordering of a smaller number of parts over a longer period of time, with sometimes just a vague estimate as to how many parts they would purchase later in the year. As Lemco Miller was also trying to implement "Just-In-Time" (JIT), the pressures to produce in small batches were immense. This combination of forces resulted in Lemco Miller's repeated lateness in shipping parts. The president of Lemco Miller described his frustration with changing customer requirements and how they have resulted in problems for the firm in terms of missed shipping deadlines and the need to stock excess inventory:

"The way it works now, customers tell us their production scenario and say you dictate the lot size. They won’t guarantee they’ll buy all that are stated in their scenario. Because set up time is so costly, and because you have to deliver parts right on time, this has had a negative impact on inventories. We tried to implement JIT ourselves, but we ended up missing deadlines...."

While this poor delivery performance record did result in the company's stocking of excess inventory so as not to have to miss shipping deadlines, it has also become the impetus for efforts to reduce set-up times which would enable Lemco Miller to deliver parts on time to customers without having to maintain excessive inventories.

Burgess Brothers also faced performance crises when a number of their customers implemented "Just-In-Time" and others were purchased by German companies. As a result, quality standards and delivery requirements
increased dramatically. As the firm owner said, "It used to be that if you made your delivery within plus or minus a week you were excellent. Now you have to do it right on time." In addition, parts delivered to several of Burgess Brothers' customers are delivered directly to the assembly line without being subject to incoming parts inspection. This has forced Burgess Brothers to ensure its quality through the implementation of statistical process control or risk losing their business altogether. This new demand for higher quality and "Just-In-Time" delivery was a major impetus for the World Class Manufacturing trajectory which the company is currently pursuing.23

Finally, Brimfield Precision also experienced a performance crisis due to environmental factors. In an 8-day period in 1991, several of Brimfield Precision's major customers failed to reorder products at the designated reorder point, costing Brimfield Precision 45 percent of its business. While this loss of business did result in a layoff of 14 percent of the companies workforce, the company also used it as an opportunity (since they had time on their hands) to implement Total Quality Management and "Just-In-Time".24

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23The company defines World Class Manufacturing as the intersection of the following elements: 1) Total Organizational Commitment (involves teamwork, cross training, continuous improvement and decision-making through consensus,) 2) Total Quality Management, 3) Sales Production, Inventory Planning, and 4) Just-In-Time Delivery.

24It is important to note here that the medical industry, per se, played little role in shaping Brimfield's decision to innovate in the ways that it has. While quality has always been at a premium in the medical field, there appears to be little pressure coming from the medical industry to be "lean and mean" as the industry, according to Brimfield, "tends to be a bit bloated." Brimfield believes that government action to reduce health care costs is going to greatly affect this, but that most of its major customers have not yet begun to worry about it. Therefore, the decision to implement changes in workplace practices at Brimfield has been driven largely in anticipation of the future.
CEO Turnover

CEO turnover was also found to have played an important role in the decisions to strategically reorient the company in each of the firms studied. At both Burgess Brothers and Brimfield Precision, leadership was passed from one generation to the next just a few years before the new generation made the decision to innovate. When notions about how to improve quality became popular in the late 1980s and early 1990s, each embraced the theory behind the innovative organizational practices and began the implementation process in their firms. Each indicated in interviews that the changes they have implemented run counter to how their fathers ran the firm, and that part of the reason for implementing these innovations was because they each believed that a new style management would enhance the companies' competitiveness in the future.

The case at Lemco Miller, while also one of CEO turnover is slightly different. In this case, a seasoned business professional sought out an entrepreneurial opportunity by purchasing his own company. He immediately began efforts to update the information systems in the facility through the implementation of computer technology. But shortly after having purchased the company, environmental forces began to create serious organizational crises for the firm, forcing it into what the firm owner calls "a survival strategy." While efforts are still being made to implement organizational innovations, this has been more difficult at Lemco Miller than at the other firms in this study, partly due to the fact that the company president lacked the lead time available to the two other firms to plan for how to manage the crisis (he was just beginning to get familiar with the company when the recession hit and customers began to change their
purchasing behavior). Nevertheless, the fact that the company did experience CEO turnover appears to be very much related to the organizational changes which have taken place in the company.

Managerial Values

Managerial values appear to have driven, in part, the decision to implement organizational innovations in Brimfield Precision, while in the other two cases this is not quite as apparent. Relative to the other two firms, Brimfield Precision appears to have attempted to create more of a family-like atmosphere with its employees. The benefits the firm offers which are designed to address employees' health and welfare appear to be more extensive than at the other two firms, although no systematic data was collected on this issue. In addition, interviews with senior management and supervisors at Brimfield Precision indicated that their interest in improving employees' worklives through employee empowerment, job enrichment and increased learning opportunities in the firm, was a major motivating factor for the firm. This is something which appeared to be a secondary motivation in the other two firms.

THE PROCESS OF IMPLEMENTATION

There is a debate in the literature over whether or not it is easier or more difficult for small firms to implement the types of innovations of interest in this paper. One argument says that small firms are likely to have fewer resources to devote to organizational innovation (particularly in terms of training) and are less able to keep abreast of the latest information on both
technological and organizational change. But the other argument, made frequently in the literature on the competitive advantage of small firms, says that organizational innovation should be easier to implement in a small firm environment because small firms tend to be more agile (i.e. less bureaucratic;) more able to respond quickly to changes in the market; and, more able to capitalize quickly on emerging market niches. There appears to be some truth to both sides of this argument, although the evidence from this research sheds more light on the barriers small firms face rather than any strategic advantage they may have over large firms.

The flurry of experimentation in the 1980s and 1990s with organizational innovation has resulted in fairly well supported propositions regarding the necessary elements in successfully implementing workplace innovations and sustaining them over time. The most commonly cited elements include a strong commitment from the top; the integration of technology, work organization and human resource strategies (as opposed to the implementation of stand-alone practices); employment security; and, the implementation of human resource practices which reinforce the rest of the organizational innovations. There is some evidence from this research that, where firms fail to incorporate the above mentioned elements into their plans for organizational innovation, they face obstacles in the implementation process. There is also evidence that no single model of innovation is emerging in practice and that elements such as employment security are surprisingly absent in many firms, suggesting that it may be possible to implement organizational innovations without it (Osterman 1993.)

This section discusses the themes which emerged from this study pertaining to the issue of implementation in the small firm environment.
While some of these themes appear equally applicable to the large firm environment, many more reflect the unique circumstances of small firms. These themes fall into the following categories: 1) the range of practices implemented varies from firm to firm, 2) small firms need sustained third party assistance, 3) training is critical in implementing worker involvement and fostering worker empowerment, and 4) firms need to overcome several barriers to effective implementation including lack of consistent organizational commitment, lack of customer support, and lack of information. These themes are each explored in detail below.

The Range of Practices Implemented Varies from Firm to Firm

In a recent, representative study on work organization in U.S. firms, Osterman (1993) found that work practices did not seem to cluster together into any particular "natural" formation that might be considered indicative of a static concept of "high performance work organization" or "transformed" firm. The cases of Burgess Brothers, Brimfield Precision, and Lemco Miller appear to illustrate this point. While each has attempted to implement the Total Quality Management philosophy, "Just-In-Time" delivery, and alternative forms of work organization, the firms differ considerably in terms of the actual practices they chose to implement. Brimfield Precision is unique in its adoption of "small business units" within the company, each of which is customer focused, involved in TQM and JIT, and driven by the use of autonomous work teams. In contrast, Burgess Brothers has implemented TQM and JIT company-wide, but has not fundamentally reorganized its machine and sheet metal shops. Rather than adopting autonomous work teams, Burgess Brothers has used the team approach in a more limited way,
primarily for the purposes of problem-solving for particular product-lines. Both companies have implemented statistical process control, but only Burgess Brothers has retained a fully functioning quality department.\textsuperscript{25} In addition, Brimfield Precision is implementing an innovative pay-scheme to create incentives for employees which are considered to be consistent with the new organizational form (this system includes pay for knowledge, pay for performance, pay for team performance and profit sharing.) Burgess Brothers does not appear to have such plans, and Lemco Miller appears to be just beginning to think about it. In comparison to Burgess Brothers and Brimfield Precision, the adoption of innovations has been more piecemeal at Lemco Miller: rather than realigning the entire organization according to an overarching strategic plan, the company has incorporated problem-solving into the firm's operations on a very micro level, with the hopes of implementing more substantial reforms as time goes by.\textsuperscript{26}

\textsuperscript{25}Brimfield management thinks it may have been too hasty in dismantling its quality department because the capacity had not yet been developed among the workers to fully implement in-process quality inspection. Therefore, the company is considering reimplementing end-inspection for the company as a whole until the internal capacity has been fully developed. However, philosophically, the company is still committed to completely "building in" quality rather than "inspecting it in" while Burgess intends to continue to do both.\textsuperscript{26}It is important to note that this issue of different managerial choices in implementing innovative workplace practices does not necessarily speak to the issue of how sustainable the innovations will be over time. It is possible that one set of practices may prove universally effective in the long run, but up to this point there is no evidence to support this notion. In fact, in a recent study conducted by Ernst and Young and the American Society for Quality Control, the authors suggest that the practices which generate the best results for firms will vary depending upon their starting position (i.e. whether they are a lower performers, medium performers, or higher performers) (ASQC 1992).
Small Firms Need Sustained, Third Party Assistance in Transforming Their Organizational Practices

In a recent Michigan study on innovative labor/management practices in small firms (as defined by less than 500 employees), the authors identified a number of differences between small firms and large firms regarding requirements for successful implementation of organizational innovations. One of their major findings was that small firms tend to need the assistance of third parties to a greater extent than do large firms (Block et al. 1990). This was primarily because the firms lacked a human resource department or individuals who could make it their sole responsibility to oversee the implementation of the innovations. The availability of a third party gave the firms an alternative, neutral resource upon which they could call to facilitate meetings, train team members, and, in general, get the new system underway until the internal capacity was developed in the firm to maintain it. The firms in the study were all union firms, and, as such, were able to call on the assistance of federal mediators to help facilitate the transition. In most cases, these services were offered free of charge.

Federal mediators tend not to be at the disposal of small, non-union firms. Therefore, those firms interested, willing and able to obtain third party assistance often retain the services of management and organizational consultants. This was true in all three cases studied in this research, although the consultant role was of much longer duration and much greater intensity at Brimfield Precision and Burgess Brothers than was true at Lemco Miller.

In two out of three cases (Brimfield Precision and Burgess Brothers), the firms hired consultants who worked with the firms on a regular basis (approximately two to four days a month) for upwards of one and one half to
two years. Thereafter, the firms continue to have a relationship with the consultant, although it has become less regular and is more on an as-needed basis. The consultant is actively involved with the firm, facilitating meetings and training sessions for people at all levels of the organization. While Brimfield Precision had, for almost an entire year, begun to implement on its own basic principles of Total Quality Management, the third party assistance played a key role in helping them to move beyond isolated principles to the development of an overall strategic plan within the organization and a roadmap for how to achieve it. At Burgess Brothers, the third party played a catalytic role early on and helped to facilitate the transition process from the beginning. While third parties came into the picture at different stages in each of these firms, both firm owners indicated that without third party assistance they never would have been able to go as far as they did with organizational innovation. "We never would have been able to make the changes we've made without a consultant," said the president of Burgess Brothers.

In Lemco Miller, there was more limited third part assistance. The firm owner, with the help of the Bay State Center for Applied Technology, brought in consultants at two different times over a two year period to assist the firm in reducing set-up costs. This effort was met with some success but lasted only a short while compared to the assistance given to the other two firms in this study, in part due to the cost of maintaining a consultant. The firm owner believes that, while the consultants' direct assistance was of limited value, the assistance in general did act as a catalyst to getting the firm to think about how to problem-solve in a number of different areas in the firm. Unfortunately, much of the problem-solving efforts ended when the
relationship with the consultant did. The firm is just now beginning to try to pick up where the consultants left off.

Developing a trusting relationship with the third party appears critical if a firm is to continue to pursue the relationship. It is important to note that the consultants used by Burgess Brothers, Brimfield Precision, and, to a more limited extent, Lemco Miller exhibited certain trust-building characteristics which appear to have contributed to the willingness of the firms to work with them. These characteristics include the following: 1) they had solid track records; 2) they were organizationally neutral; 3) they understood the small firm environment; and 4) they did not come free. These characteristics and their implications are discussed in further detail below.

Each of the third parties in the cases studied had prior records with success that the firm owners believed they could trust in. While most of the third parties were strangers to the firms prior to becoming involved with them, each had a sufficient experience to warrant the firms' attention to what they believed the company needed to do to enhance their competitiveness. For instance, the consultant used by Burgess Brothers has recently helped one small firm in the western part of the country to go from being a $5 million company to a $20 million company in just a few years. At Brimfield Precision, the consultant had successfully revived a failing company and was the subject of a PBS Tom Peters special as an example of the "major turnaround of the year." The consultants at Lemco Miller offered less dramatic records, but were known by the president to have done sufficiently good work with other small companies in the Commonwealth.

Second, the consultants were organizationally neutral. This concept of objectivity seems to have been very important in each of the cases studied. As the firm owner at Brimfield Precision put it, "[The consultant] didn't seem
to have an alliance with employees or management - just the firm and the customer."

Third, the consultants understood the situation of small firms. Each of the firms' studies indicated that the consultants had a good understanding of what was possible to achieve in a small firm environment and what time frame would be necessary to implement the innovations.

And finally, the consultants were not necessarily cheap, let alone free. In each of the cases, the firms were required to pay moderate to large sums of money (in some cases tens of thousands of dollars) for the consultants' services, and this at a time when each was experiencing serious financial constraints. While Lemco Miller's consultants were underwritten, in part, by a state economic development program, Brimfield Precision and Burgess Brothers paid in full for the services they received. Interestingly, Brimfield Precision and Burgess Brothers appear to be more personally committed to the innovations than is Lemco Miller, raising the question of whether or not there is a correlation between the amount of money spent and the commitment to change, a subject which is beyond the scope of this paper. In any event, there is evidence to suggest that when small firms believe that assistance is worth the price, they are willing to pay for it.

Management and Employee Training is Critical in Implementing Worker Involvement and Fostering Empowerment in a Small Firm Environment

Implementing such innovative workplace practices such as TQM, "Just-In-Time", and alternative forms of work organization require changes in roles, responsibilities, behaviors, and sometimes even values. Attempting to do this without the proper training can prove problematic for firms
seriously interested in changing the way they do business. The importance of this training for managers and employees is discussed below, as is the role community colleges played in the cases studied in providing training.

The Importance of Management Training

In a small, non-union environment it is the responsibility of management to decide to implement organizational innovation and to make it happen. A 1991 survey of metalworking firms in Massachusetts indicated that firm owners recognize that they and their managers need instruction in a number of areas, but that training in worker involvement topped the list - close to 80 percent said this was sorely needed (Cann, Forrant and McGraw 1991). Indeed, worker involvement and empowerment have proven problematic at Lemco Miller. This appears in large part to be because, in a small firm environment, there is no human resource person to design, coordinate, and reinforce such efforts. Therefore, the degree to which worker involvement and empowerment becomes a reality depends almost exclusively on the skill and commitment of the firm owner himself and that of the front-line manager(s).

At Lemco Miller, both the president and the plant manager appear to believe in the concept of employee empowerment and the potential it can hold for the firm, but they have had difficulty implementing it. The president remarked: "It's hard for people to change, but I also think I didn't really state it right or enforce it well enough or communicate it well enough. Maybe I gave mixed signals." The president also said that to properly implement employee involvement, one needs someone on it all the time
who is committed to it. "We just don't exude that kind of enthusiasm." He also went on to say that "it is a draining exercise when you can't do it well."

Burgess Brothers and Brimfield Precision appear to have experienced more success in this regard. Management training was an integral part of the consultants' agenda in these firms, and, as such, managers appear to have been better prepared for dealing with the issues that arose in redefining workers' roles and involving them in the decision-making process.

The Importance of Employee Training

In order for firms, large or small, to successfully implement substantial organizational innovations, employees must be equipped with the skills necessary to effectively take on more responsibility within the firm. As Bailey (1992) expressed:

"Even if employees want to participate, the effectiveness of that participation can be limited by their skills and knowledge. Employee participation is usually designed to get workers to generate ideas, suggestions, and improvements and to carry out their work more creatively and with less supervision. In most cases, this will be more effective if they have adequate education, problem-solving skills, and a good understanding of the processes and organizations in which they are involved (Bailey 1992.)"

Training has played a limited but important role in Burgess Brothers and in Brimfield Precision. In the case of Burgess Brothers, all employees participated in 16-hour training courses in the practices of statistical process control, "Just-In-Time" delivery, general problem solving and team-related skills building. At Brimfield Precision, all employees have participated in an introductory course in statistical process control conducted on-site by the former head of the quality department and have participated in informal training sessions with the consultant on teamwork. These initial training
courses were critical to the initial implementation of these particular practices, but there is also evidence that follow-up courses are badly needed. For instance, at Brimfield Precision, employee interviews revealed that many employees view SPC as collecting and inputting data, but very few demonstrated an understanding of what it means to interpret the data and to use it to make corrections to the work process. This inability to fully utilize the SPC process may be a contributing factor to an increase in the number of shipments returned to the company due to defective parts. The company recognizes the need to follow up the training with a more advanced course but has not yet found the time to do so.

Lemco Miller has done far less in terms of training, except for skill-specific types of training programs having to do with working on a particular piece of technology. This lack of training in more general problem-solving and team-related skills appears to be a contributing factor to the more limited progress the firm has made in its teaming efforts relative to the other firms.

The Role of Community Colleges in Management and Employee Training

Several authors suggest that community colleges can and do play an important in providing training and other assistance to small firms who lack the capacity to deliver training themselves. Evidence from the case studies in this research indicates that community colleges, while potentially helpful, played little to no role in these cases.

The only instance in this research where a firm enlisted the assistance of a community college was in the case of Lemco Miller. The firm owner and plant manager participated in a TQM seminar offered by the local community
college and found it useful in exposing them to new ideas and concepts. The course involved field trips to high performance firms (one of which turned out to be a customer of Lemco Miller's) so that the participants could see what innovative practices actually look like when they are implemented. While the training itself was useful, both the plant manager and the firm owner found the organized field trips to be of the most use to them. In general, they view the potential of community colleges as limited - that the real problem for small firms is the lack of ongoing support for implementing innovative and sustainable workplace practices. The firm owner remarked, "The problem is there is no sustained assistance. We need the transfusion drip, not the one big catalyst (such as a one-time training program)."

In general, there were two main reasons why the firms studied did not investigate the services available to them and their employees from the local community college: 1) they wanted to develop an internal training capacity to minimize downtime in the shop and to tailor the training to the specific needs of the firm, and, 2) because they believe that the training available at community colleges is too theoretical, inappropriate, unproven or of little value. For example, neither Burgess Brothers nor Brimfield Precision sought the assistance of community colleges in their area. From the very beginning, these two companies were mainly interested in developing the internal capacity to train their own people. Neither firm is even really aware of what local community colleges offer in terms of TQM or other such subjects. Both firms prefer to have the ability to tailor programs to their own specific needs and find it more cost effective to train on site since this minimizes downtime in the shop. For instance, Burgess Brothers conducts its training over the lunch hour, with half of the time contributed by the employees, half the time contributed by the firm, and lunch provided by the firm. When Lemco
Miller was asked why it did not send its employees to the community college, given that management found it of some value, the firm owner responded that the training was too theoretical for the guys in his shop: "Being able to see [innovative practices] is more effective than learning the theory behind it - it can be very contagious. Besides, my guys are not into the touchy feely stuff." Second, he indicated that it was too expensive to send his employees, not just in terms of the course fees but also the costs associated with lost production, something which the company can ill afford: "We have no spare capacity. We're scheduled out. We miss a beat and it hurts."

**Firms Need to Overcome a Set of Barriers which Exist in the Implementation Process**

There are a number of barriers that firms in this study face, in varying degrees, in the implementation process which make it difficult to implement changes in its organizational practices. These barriers include a lack of organizational commitment to the changes, a lack of support from customers, and lack of information.

**Lack of Organizational Commitment**

While many employees indicated that they like the changes that are being made within their firm, many others indicated that they had ambivalent feelings toward them, largely due to their perception regarding management's commitment or intentions vis-a-vis the innovations. These feelings have four primary root causes: 1) a feeling that their employer is not truly committed to employee empowerment; 2) a resentment that they are
not being rewarded for their efforts; 3) a fear of losing their job as a result of the innovations; and, 4) an overall lack of commitment to the firm.

Many employees interviewed credit their firms with having adopted the TQM philosophy in general, and employee involvement in particular - most think it is right on target. But they also question the company's commitment to it. One interviewee indicated that management was acting in ways which are inconsistent with the supposed new organizational philosophy: "We're not walking the walk yet. There are still a lot of dictates." One employee offered the example of when management made a decision that she thought the team should have made: "If [managers] want us to be a team [they] have to let the team be a team." Of the firm owner, another employee said, "He's got to support us. You need support from the owner as an individual: just a simple 'How's it going?' He can't interfere or take away our suggestions." Another employee put it this way: "It's supposed to be a team management thing now. People feel like management hasn't let go." And still another employee said, "Attitudes have to change. They (management) can't always be coming down on us. Decisions by the team should stay." This feeling that management is not committed to the organizational innovations appears to be creating uncertainties as to whether or not the innovations are going to last, uncertainties that may negatively impact the implementation process.

A majority of employees interviewed indicated that they do not feel as though they are being valued or rewarded for the extra effort they are being asked to expend. As a result, morale appears to be low. In at least two out of the three cases, employees have not received pay raises in quite a long time. One employee said, "It really irks people when management says 'money isn't everything'. People are really getting sick of that statement." A number
of employees pointed to recent high turnover rates as a function of low employee morale. "People are leaving because they are fed up with not being rewarded for their efforts and for being required to do more work." One employee noted that there are a lot of costs associated with training new people, and that he thinks the money would be better spent making people happier.

Workers, in some cases, fear that they may lose their jobs as a result of workplace innovation. This fear may be justified. Evidence from this research suggests that unless companies simultaneously increase sales while converting to high performance (or have plans to do so), it is possible that a more efficient plant may not have enough work to retain all of its employees. At Burgess Brothers where cellular manufacturing is being implemented, workers are keenly aware of what happens when secondary responsibilities are assigned to them: these responsibilities have been taken away from other workers in the shop. While workers are not aware of any overarching plan to eliminate jobs in the company, the firm owner did indicate that, by moving toward cellular manufacturing some workers would most likely become redundant. For instance, the company has plans to configure four to five work cells, each with just two operators, and with three floaters to fill in where necessary to ensure a smooth work-in-process inventory. This arrangement could result in a substantial reduction in the amount of labor necessary to carry out the work, unless more work is brought into the company before downsizing becomes necessary.27 For firms such as Burgess Brothers concerned about unemployment insurance, workers compensation

27The firm owner at Burgess Brothers doubts that sales will expand rapidly enough to justify not laying off workers. In fact, he indicated that he is planning for slow and managed growth for his firm, which, in the long run, may result in more jobs but, in the short run, may necessarily result in layoffs.
and health care costs, staff reductions appear to be a desirable result, if not the actual goal of the innovation. However, from the point of view of the individual employee this result is at best a demotivating factor and may create barriers to the firm in the implementation process.

Workforce reduction fears are less evident in firms which have explicit plans to grow rapidly in the future. Except for an initial layoff in conjunction with the 45 percent loss of business in 1991, workforce reductions appear not to be a part of the Brimfield Precision organizational plan. Largely because this company has adopted the small business unit approach to reorganization, some roles and responsibilities have actually been tripled within the organization. Where there used to be only one worker performing a task for the entire organization, now two other workers have had to assume those responsibilities (in many cases in addition to their own) so that they can perform the work for their respective business units. Brimfield Precision management indicated that someday it might actually like to see the business units spin off into entire businesses of their own.

The final point regarding lack of commitment on the part of employees has to do with the fact that many of the employees interviewed appear to have little loyalty to their current employers. This appears to be a response to the fact that, in general, small firms tend to have little loyalty to their employees, as indicated by the fact that as the work load ebbs and flows, so too does the workforce (either by way of layoffs or by cutbacks in hours.) This lack of loyalty on the part of employees may detract from a firm's ability to implement organizational innovations which require high degrees of employee commitment. In addition, because the firms are small, there is often little in the way of upward mobility for shop floor employees. Many of the employees interviewed indicated that they have worked for a number of
different companies, and are always looking for better options elsewhere. Few perceive any long-term opportunities for them in their current job. This may have serious consequences for companies attempting to innovate, particularly because the innovation process can take up to five years to accomplish. For instance, Brimfield Precision is two and a half years into its innovations, and its employees have not received a raise within that time. Morale has suffered as a result. While plans are in place to introduce an innovative pay scheme, Brimfield Precision management does not expect it to be fully in place for about five years. In response, one employee said, "What do they think we are? Lifers?" Clearly, some employees have no expectation of making their current employer their permanent employer. Employees also indicated that they had no expectation of being able to further their education with their current employers: small firms do not have a history of providing educational opportunities to their workers. It is unclear how dedicated workers will be to implementing innovations when they have no expectation of remaining with their current employer. This lack of a stake workers have in the firm, as a result of their short time horizons, may preclude them from perceiving any vested interest in the outcomes of the changes.

All Customers Are Not Equal in Their Desire or Ability to Assist Suppliers in a Move Toward High Performance Work Organization.

Much of the literature espousing the virtues of developing customer-supplier linkages assume that customers have the ability to move their supplier base toward high performance forms of work organization, and that they see an interest in doing so. This study indicates that, in this regard, not
all customers are created equal. Burgess Brothers is the one exception in this study. A number of its customers are implementing similar types of innovations and are channeling information to their suppliers so that they can do the same. One customer requires its suppliers to apply for the Malcolm Baldrige Award, the national award for quality, which is based on the extent to which the firm has successfully implemented a host of organizational innovations to enhance quality and customer service. Other customers are pursuing ISO 9000 certification, something which is required of firms wishing to do business in the European Community, and are beginning to require it of their suppliers.

These customers appear to be qualitatively different from those of Brimfield Precision and Lemco Miller. Only one customer of Brimfield Precision's is pursuing TQM and "Just-In-Time". The rest have not yet felt nor anticipated the quality and cost crunch in the health care field which many, including Brimfield Precision, believe is imminent. Brimfield Precision believes that as long as their customers do not feel the pressure to improve quality and increase efficiency in the health care field they will not see organizational innovation as necessary. Lemco Miller indicated that few of its customers are actually implementing substantial organizational innovations, and even fewer are pursuing ISO 9000 certification. The president thinks that getting ISO 9000 "would be a helluva good marketing thing," but his customers aren't doing it, let alone forcing their suppliers to do it. This worries the president because he sees it as inevitable, but doubts he as a supplier will do it unless and until his customers require it.

In addition, Lemco Miller's customers have not been forthcoming in providing direct assistance to the firm. At one point, the president says he tried to convince his customers to allow him and his employees to visit so
that "they can show us by example and have their people walk us through."
The response he has gotten has been, "Sure, great idea," but so far this has not yet happened. Or they'll say, "Sure, we'll train you, but we'll charge you for it." Miller says it would be really helpful if his customers sent someone down to the shop - "All we're looking for is a validity check that we're doing things right as a supplier." So far this hasn't happened either, and, according to the president, "It gets embarrassing to keep asking."

Information on How to Innovate is Haphazard, Too Expensive, Or Non-Existent

One problem that seems particularly acute in the small firm environment is that information on organizational innovation is hard to come by. In each of the cases studied, there is evidence that information on innovative workplace practices has been haphazard, too expensive or non-existent.

Both Burgess Brothers and Brimfield Precision were lucky enough to have stumbled upon sources of assistance, but it is probably safe to say that this discovery was fairly haphazard. Brimfield Precision happened to receive a brochure from MIT advertising the Deming Tapes which have played a strategically important role in the company's efforts to implement Total Quality Management. In addition, the company received a flyer advertising a talk that a consultant would be giving at an NTMA function - the same consultant who later came to work for Brimfield Precision. Burgess Brothers, by chance as well, learned of their consultant via an announcement that he would be giving a ""Just-In-Time"" seminar at an upcoming vendor show.
Lemco Miller, while able to access assistance from a state economic development program, has been unable to follow-up on the innovations on its own. The company receives brochures daily advertising books and video tapes which promise to turn a company into a "World Class Manufacturer," but the materials are all exorbitantly expensive (often costing thousands of dollars) and the president feels like he has no way of knowing whether or not the tapes are any good: "These materials may hold the answer for me and my company, but they're too expensive for me to make a mistake if they don't."

As much as Burgess Brothers has been able to achieve in terms of its organizational innovations, access to information has also created a problem for this company. Burgess Brothers has been in the process of implementing information systems to document internal processes necessary to qualify for ISO 9000 certification. Unfortunately, the company has been unable to locate any software to help them to do this. Indeed, the company does not even know where it should look for assistance.

THE OUTCOMES

After having reviewed many of the problems and barriers associated with implementing innovative workplace practices, the logical question is, is it worth it? The evidence from this study suggests that, despite the barriers and problems associated with implementing organizational innovations, doing so can yield positive outcomes for the firms and their employees.
Organizational Innovation Can Result in Obvious and Direct Improvements in Firm Performance

The Michigan study referred to earlier in this paper found that a much closer and direct relationship exists between innovative practices and firm performance in small firms as compared to large firms. In the case of large firms, the authors suggest a couple of reasons why such a direct relationship has not been apparent: first, that most of the studies conducted in large firms focus on single organizational or human resource practices and various outcomes when, in fact, most organizational and human resource practices occur in clusters; and second, that in a large firm environment "the complexity and multiple factors affecting the performance of large firms make it difficult to isolate the impact of [organizational innovations] on firm performance (Block et al. 1990)." In their study, the authors found "unambiguous connections" between the innovations and firm performance, attributing this finding to the "relative simplicity of the economic environment in which these firms operate and the fact that they have very little flexibility in terms of what has traditionally been called strategy (Block et al. 1990)."

In the firms in this study, there also appears to be a very direct connection between innovative workplace practices and firm performance, although it is too early to conduct a full assessment. Even so, innovation does appear to be paying off. At Lemco Miller, the plant manager indicated that, as a result of the team problem-solving activities in the CNC milling machine team he could see a productivity increase that approached 25 percent. At Brimfield Precision, while they have not actually attempted to measure productivity per se, there is evidence that the increased
communication between engineers and machinists has greatly reduced lead
times in developing new products. For example, one engineer noted that,
before the company moved into small business units, it would typically take a
month to develop a new product. If he had a question for a machinist, he
would have to go to the opposite end of the building to ask it, greatly
hampering communication. Now, with the reorganization, the R&D
machinist sits right behind him. As a result, the engineer says that he has
been able to develop three new products in a two-week period, something
which was unheard of before. In addition, with the implementation of SPC
in the company, some managers have witnessed a great reduction in scrap
rates which they directly attribute to the fact that individuals and teams are
taking more responsibility for quality. At Burgess Brothers, the president said
that within six months "the consultant paid for himself" with the increased
savings the firm experienced. According to the firm owner, these increased
savings were a direct result of group problem-solving and the
implementation of statistical process control, both of which have greatly
reduced the overall cost of quality in the company.

Employee Empowerment, Where Successfully Fostered, Results in Greater
Job Satisfaction and Overall Morale

While employee empowerment has been difficult to achieve, where it
has been fostered successfully there is evidence that it greatly increases job
satisfaction and overall morale. Brimfield Precision offers a good example of
this. One employee said, "For what we are doing now, you have to know a
lot more. You have to keep track of jobs more. There's more empowerment
and skills. I don't just feel like I'm sitting here working." Other employees
also say that they feel really good about themselves now. For instance, one employee said specifically that the organizational changes have "upped" her self-esteem. "I feel like I'm worth something now. Before I was just a bench inspector." Another employee, referring to his increased authority, says that he likes the fact that he can just sign his name and the company orders the part. "Now they let you do the job." A different employee says he likes solving problems, and now he gets a chance to do it. "Before it was the boss or quality people who solved problems. It gives you a real good feeling when you get to solve problems." Finally, one employee, referring to his increased responsibility in conducting in-process quality inspection, explained: "... when you do your own quality, it's a real confidence builder - you know you've stretched yourself out to the max."

THE ROLE OF SMALL FIRMS IN DIFFUSING INFORMATION ON INNOVATIVE ORGANIZATIONAL PRACTICES

A recent study conducted by Jobs for the Future, Inc. suggests that small firms, in addition to learning from their customers, can very effectively learn from each other and that, indeed, they look to each other for ideas on how to improve their operations (Flynn 1993 forthcoming). Given that this learning avenue exists, a final and logical question of interest in this study is to what extent are small firms willing to share their experiences in implementing organizational innovations?

Schrader (1992) suggests that the degree to which firms are willing to transfer information depends on the perceived costs and benefits of doing so. In weighing costs, he looks at factors that influence the degree to which an information transfer affects the rent expectations of the transferring firm. In particular, he identifies the following three factors: 1) the degree of
competition between the firms, 2) the availability of alternative information sources, and 3) whether the information relates to a domain in which the involved firms compete. In weighing the benefits, he identifies the following three factors: 1) the likelihood that the information receiver will reciprocate information, 2) what the value of the transferred information is to the information receiver, and 3) what the technical expertise is of the information receiver (Schrader 1992).

This framework provides some insight into the decision-making processes of firm presidents such as those of Burgess Brothers and Brimfield Precision. That they do not share information with direct competitors appears to be related to the fact that they see the information they have as giving them a competitive advantage over their competitors; as such sharing this information would necessarily result in a diminished rent expectation. In contrast, sharing information with suppliers helps to ensure the quality and timely delivery of the products they purchase, and sharing information with customers solidifies their position in the supplier chain. Sharing information with non-competitors results in no diminished rent expectation, and, it is perceived, may result in benefits accrued to the sharer of the information from any reciprocity which may develop as a result.

Those firms in the study which are most committed to the organizational innovations they have implemented (Burgess Brothers and Brimfield Precision) are extremely enthusiastic about the strategies they have adopted. In fact, one firm owner indicated that becoming involved with such things as TQM is like "getting religion" and, as a result, "you want to spread the gospel." Clearly, this is demonstrated by both companies' willingness to open their doors to their customers, suppliers and some other companies interested in seeing what these innovations look like in practice. But this
enthusiasm and willingness to share information does not get extended to other companies perceived to be direct competitors.  

Burgess Brothers, like Brimfield Precision, is very proud of the innovations the company has implemented and has been very open to showing customers, suppliers and non-competitors all that the company has been able to accomplish. For instance, one manager at Burgess Brothers indicated that it is not unusual for a customer to visit Burgess Brothers to see how they have gone about implementing "Just-In-Time" and other organizational innovations. In addition, this manager indicated that he had been "feeding some customers stuff on ISO 9000." Management sees this as an important way of enhancing their relationship with their customers. In terms of suppliers, the Director of Manufacturing expressed how Burgess Brothers has a real interest in working with suppliers on improving their operations. "Materials are the most important thing. We can't make good parts with lousy or late materials." As a result, Burgess Brothers has brought suppliers into the company for tours of the operation and has worked with them to reduce turn-around time on jobs. For example, Burgess Brothers has a supplier who supplies plating services - something which the company lacks the internal capacity to do. In describing this plater and the work that Burgess Brothers has done with it, the Director of Manufacturing said, "It used to be a two week process for a plating job to turn an order around. Now three days is max." According to Burgess Brothers, working with this particular supplier has really paid off: "now he's the best plater we've got."

Finally, Burgess Brothers appears to have an open-door policy for inquiring non-competitors. Lemco Miller learned of Burgess Brothers' efforts

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28In fact, when the firm president of Burgess introduced the author of this study to others on the management team, he joked that, while I claimed to be a graduate student, I actually worked for one of its competitors and was sent to spy on their operations.
through a mutual financial consultant and was invited to witness the company's organizational innovations. While both companies share a particular customer, they produce different types of parts and do not directly compete.

Brimfield Precision has developed strategic alliances with a number of its suppliers which have resulted in extensive information sharing. For instance, one cooperative relationship with a supplier came about when a customer of Brimfield Precision's asked them to do some casting and forging for them - jobs for which Brimfield Precision lacked the internal capacity. The president said this kind of alliance worked because Brimfield Precision does not compete with its suppliers; rather they are able to work together to generate more business for both. Brimfield Precision has had less success developing these connections and sharing information with all but the most enlightened customers, although they have tried to do so. As the president of Brimfield Precision described, "We thought maybe we can go in and show our customers better ways of doing things. We went to one company with a JIT plan and they said, 'no, our inventory system doesn't work that way.' It was so far beyond what they were capable of thinking of." In any case, the company is still willing, indeed sees it in their interest, to share information with their customers on innovative organizational practices.

The president of Brimfield Precision sees the kind of strategic alliances he has been trying to build as qualitatively different from the kind that TECnet, a publicly sponsored networking organization, attempted to build in 1990-1991 in the western part of Massachusetts. While the perception of the organizers of this effort was that the firms in the potential network were experiencing severe competition from other states as well as from abroad and that they could all benefit from joint activities - including information
sharing, the reality was that, on a day-to-day basis they were still very much competing with each other for local contracts. The Brimfield Precision president explained that, rather than simply being "unenlightened," these firms were responding in a way which was consistent with the competitive realities they faced. Perhaps, offers Brimfield Precision, the effort was simply "before its time."

CONCLUSION

Small firms pursue organizational innovation for a variety of reasons, including an increase in their awareness of changes in the external environment, poor performance, CEO turnover, and managerial values. The experiences of the firms in this study indicate that the implementation process is very complex and tends to vary a great deal from firm to firm. Of the most important findings in this study is that third parties play a critical role in implementing innovations in small firms. In addition, training for managers and workers appears to be very much related to how well the innovations are implemented.

This study also indicates that, in general, small firms face several barriers which make it difficult to innovate: first, employees often lack a commitment to the innovations due to a) a perceived lack of commitment on the part of the employer, b) resentment for not being rewarded for their efforts, c) fear of losing one's job, and d) a lack of loyalty to the firm. The lack of support from customers partially explains why some small firms have even more difficulty than others and the lack of information on organizational information also appears to be a serious obstacle to small firm innovation. In spite of the difficulties small firms face, however, a number of
very positive outcomes are apparent for those firms that diligently pursue innovation. They witness obvious and direct improvements in firm performance and greater job satisfaction and overall morale on the part of their employees. Finally, small firms play an important role in diffusing information on organizational innovation, but only when it comes to non-competitors. Evidence in this study indicates that firms are more likely to share information with customers, suppliers and non-competitors than they are with direct competitors due to a diminished rent expectation associated with sharing information which they perceive as giving them a competitive advantage.

Having discussed the major findings, and having concluded that organizational innovation, while difficult to implement, can result in positive outcomes for firms and their employees, we now turn to the role of public policy in assisting firms in the adoption of workplace innovations and mitigating against the barriers small firms face in the implementation process.
VI. THE ROLE FOR PUBLIC POLICY

The evidence from this research indicates that, while small metalworking firms experience serious obstacles in implementing organizational innovations, doing so can result in positive outcomes for the firms themselves and for the people who work for them. This section addresses the role for public policy, suggesting ways in which economic development policy makers and practitioners can help to facilitate the transformation process while simultaneously mitigating against any barriers which make innovation difficult to achieve.

Because other researchers have considered various aspects of the issues of concern in this paper before, several recommendations for a more active public policy role in assisting small firms have already been developed. These recommendations fall into the following categories: 1) Promoting Best Practice (Flynn 1993, forthcoming); 2) Facilitating the Development of Customer-Supplier Linkages (Bosworth 1991); 3) Fostering the Development of Networks (Piore and Sabel 1984) (Bosworth 1991) (Bosworth and Rosenfeld 1992); 4) Creating Incentives for Trade, Industry, and Community Associations and Organizations to Engage in Activities which Promote High Performance Work Organization (Flynn 1993, forthcoming); and, 5) Brokering Information and Direct Assistance to Small Firms via Industrial Extension Services (Shapira 1990) (NIST 1992).

Rather than reiterate at length what others have explored in detail elsewhere, this section briefly summarizes these policy recommendations and illuminates to what extent the evidence from this study supports them.
Promoting Best Practice

While small firms tend to implement (or not implement) organizational innovation for a variety of reasons over which the public sector has little control, there is evidence that spreading information on best practice provides firms that are open to change with ideas and information on how to do so. Therefore, some argue that the public sector, particularly on the state and local level, should promote best practice in a number of ways including implementing industry-driven quality awards for local firms and collecting and disseminating information on best practice whenever possible.

The evidence from this research suggests that the promotion of best practice can be a powerful tool to encourage firms to adopt innovative workplace practices as long as the best practice examples are of firms with demonstrable outcomes that can be attributed to the innovations. Given that, the promotion of best practice can increase firms' awareness of alternative models for doing business, creating an incentive to seek assistance on implementing organizational innovations. Particularly in the case of Brimfield Precision and Burgess Brothers, awareness of best practice helped to drive the firms' interest in pursuing innovation.

It is important to note that, as long as the number of innovative firms remains relatively small, the promotion of a few best practice cases can be a powerful incentive for firms also looking for a competitive edge. As the number of innovative firms grows, however, the promotion of best practice is less likely to provide "competitive-edge appeal"; rather, it may begin to set a standard below which firms interested in staying business can not go. In other words, the more "public" the information becomes (through best practice promotion), the less likely firms will be to perceive the information
as providing a "competitive advantage." This would also increase the likelihood that firms themselves will share information on at least the most basic of innovative practices with other firms, thus helping to raise the standards for organizational innovation overall.

Facilitating the Development of Customer-Supplier Linkages

Customers have a tremendous amount of market power when it comes to their smaller supplier firms. It is not too unusual to hear a small firm owner say, "They say jump and we say how high." Best practice firms such as Motorola recognize this power and have used it to "encourage" (read require) their suppliers to pursue organizational innovation. Some economic development policy makers and practitioners have identified the important role that customer-supplier linkages can play in providing small firms with the impetus, and often the wherewithal, to update their workplace practices. Programs, often referred to as "Supplier Institutes" are being developed in the Commonwealth and around the country to facilitate the development of closer customer-supplier linkages.

The evidence from this research indicates that the development of customer-supplier linkages could be of great assistance to small supplier firms in giving them unambiguous information as to what they need to do to update their workplace practices. Where large customers do engage their suppliers in efforts to improve workplace practices (such as is the case with Burgess Brothers) the incentives for the small firm to do so are greatly increased, supporting the notion that public policy should play a role in facilitating these linkages. However, not all customers see an interest in assisting their suppliers in improving their organizational practices,
preferring to maintain the traditional, arms-length relationship. It is among this customer population where the greatest challenges exist. In this regard, a best practice promotion policy could help: the advertisement of best practice customer-supplier linkages could be used to sway other customers to engage in such activities themselves.

Fostering the Development of Networks

There is a great deal of literature emerging suggesting that public policy should foster the development of interfirm networks among small firms. The idea behind these networks is that individual firms lack market power and resources, both of which could be enhanced by joining together in cooperative working relationships. The key in developing these networks is to get firm owners to see the advantage in what is sometimes called "cooperating to compete."

On this subject, the research here offers a cautionary note: public and private sector efforts to develop cooperative interfirm relationships should be extremely sensitive to the relationships which already exist between firms. Opportunities for collaboration do exist, as is evidenced by some of the alliances which formed naturally between the firms in this study and their suppliers and customers. These opportunities could be broadened if the role of identifying these types of opportunities was played by a facilitative public or private sector organization. In general, it appears that the concept of networks may be more compelling for firms in the Commonwealth if the networking activity focuses on developing linkages between firms that provide complementary services rather than firms that perceive themselves to be in direct competition.
Creating Incentives for Trade, Industry, and Community Associations and Organizations to Engage in Activities which Promote High Performance Work Organization

Some argue that trade, industry, and community associations and organizations could play an important role in promoting high performance work organization if they were to make it an explicit objective to do so. Incentives could be created, it is argued, to encourage these associations and organizations to move in this direction.

There is support in the case studies that associations and outside organizations, while of little assistance in the cases studied, could have been of great help to the firms. The trade association to which these firms belong or have belonged previously already provides legal, labor, and environmental assistance and could be a tremendous help in diffusing information on innovative organizational practices such as TQM and Just-In-Time delivery, as well as alternative forms of work organization. One very useful service for member firms would be to develop a library of literature and video tapes on organizational practices and provide reviews of the materials to help firm owners sort through all of the flyers that come across their desks on a daily basis. On the local level, the trade association could sponsor guest speakers on a regular basis who are seasoned in the work of organizational innovation as another way of exposing member firms to new ideas. However, the fundamental problem here is that there does not appear to be any organized demand for these services on the part of the general membership. The firm owners at Brimfield Precision and Burgess Brothers both have leadership positions in their trade associations and have tried to use their position to promote organizational innovation, but the response from members has been weak at best. This may argue for a more firm-based
incentive strategy as well as support to trade associations which attempt to offer such services in the face of low demand.

Community Colleges are the second type of organization that could play a bigger role in assisting firms. First, they could develop relationships with the larger customers to which their local firms supply to develop industry-certified curriculum which could be available to them and to their supplier firms in the area. This would add legitimacy to the training offered by the community college, something which would most likely increase the probability of firms' taking advantage of it. Second, community colleges should be sensitive to the interest of firms in developing internal training capacity and should offer and advertise heavily train-the-trainer courses for managers and team leaders. Third, they should attempt to implement courses that are practical, hands-on, and sensitive to the needs of the adult learner. This would make the training more attractive, both to the firm owners and to their employees.

Brokering Information and Direct Assistance to Small Firms via Industrial Extension Services

One widely touted model for providing information and assistance to small firms is the development of a state-wide and/or national industrial extension service modeled after the highly successful agricultural extension service. This extension service model typically involves the provision of inexpensive or free technological and organizational assistance to small firms who need it.

This is, in fact, happening in one part of the Commonwealth. A consortium of major corporations has recently certified Northern Essex Community College as its designated training center for local suppliers.
There is no question that firms need more and better information and assistance. But on the question of whether or not the public sector should engage in industrial extension services in the traditional sense, the evidence from this study offers some caution: firm owners do not appear to be willing to take advice from just anyone. They look for people who have proven track records and who understand the small firm environment. Recruiting highly experienced agents may prove to be a very difficult task, and the likelihood of being able to provide competitive wages as compared to what can be made in the private consultant market seems remote, since firms who can afford them will always look to consultants who can provide a "competitive edge." In addition, while small firms lack the kinds of resources larger firms have, there is evidence that a financial commitment is often important in establishing an organizational commitment. Furthermore, it is questionable of what value firms will perceive publicly sponsored services to be if they are free or relatively inexpensive. Conversely, if they have to pay for it, how willing will firms be to pay for government services of questionable value? It may be that a public information-brokering role would be more effective than the creation of a public program which provides direct services. It may also be that a public underwriting role and/or sliding fee arrangement would assist firms who truly lack the financial resources to support a consultant. But here a great deal of caution is warranted lest public dollars replace private ones.

It is possible that a two-tiered approach to providing information and assistance to firms is warranted. For instance, community colleges or regional assistance centers may be able to provide general information to firms on organizational innovation and facilitate field trips to best practice firms as a way of giving small firms "the lay of the land" when it comes to innovation. This type of general introduction to innovation could lead small firms to
pursue relationships with organizational consultants who could then provide firm-specific advice and assistance.

A Final Recommendation

Much of the public policy recommendations are offered by academics and economic development practitioners and policy makers with strong regional and national perspectives. While they recognize that more efficient small firms may necessarily require less labor (unless business grows as a result of the innovations), they assume that skilled workers will somehow be absorbed by the regional economy. However, the impacts on a particular locality at one point in time may be painful if local firms are unwilling or unable to grow while simultaneously implementing innovations, thus allowing them to maintain their staffing levels. Therefore, it is important for local and regional economic development bodies to a) target, wherever possible, assistance to firms that demonstrate an explicit interest in growing, and, b) develop regional employment or business development programs to deal with any problems of worker dislocation which may result from organizational innovation.
VII. CONCLUSION

Small metalworking firms in Massachusetts face a series of challenges. Declining market opportunities in some domestic markets and increased national and international competition are requiring many companies to question their traditional organizational practices. Some firms, such as the ones in this study, are attempting to implement a series of workplace practices designed to increase worker participation, improve quality, and meet increasingly stringent delivery standards in an effort to enhance their overall performance. Many other firms, however, appear to be either skeptical of the benefits of these innovations or too overwhelmed with their current environment to undertake what can be a time and resource-intensive process.

Research into the experiences of three metalworking firms in the Commonwealth, Brimfield Precision, Burgess Brothers, and Lemco Miller, indicate that small firms, even with their limited resources, can in fact implement organizational innovations that result in positive outcomes for the firms and for the people who work in them. But this research also indicates that success is uneven across firms, that the implementation process can be a rocky one and that commitment to these innovations can get tested at various points along the way. While the actual catalyst which sparked the decision to pursue innovation may vary from firm to firm (as do the actual practices implemented), in all cases third parties played and continue to play a key facilitative role in helping the firms to negotiate their way through difficult stages in the process. Training is also a critical component to the successful implementation of innovative workplace practices. In addition,
small firms face (in varying degrees) a series of barriers including a lack of perceived and/or real organizational commitment, a lack of support (in some cases) from customers, and, oftentimes, a general lack of information.

While market forces are shaping the context in which firms operate, public policy can help firms respond effectively to the changing competitive environment. Public policy can play an important role in supporting firms through the transition process primarily by building cooperative relationships between non-competing firms, promoting best practice, and providing information-brokering services to local firms. With the long-term survival of the Commonwealth's manufacturing base at stake, this form of public-private partnership could play a potentially powerful role in facilitating the transition to high performance.
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