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Strategies to Support the Plastics Industry in North Central Massachusetts: A Report to the City of Leominster

University of Massachusetts Donahue Institute

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Executive Summary and Recommendations

Context for This Study

As one of the key economic sectors in North Central Massachusetts, the plastics industry has been the subject of continuous discussion, study, and debate for more than ten years, producing an array of comprehensive reports and analysis. A focal point of this discussion has been the proposal to create a "plastics technology center" to serve the North Central Massachusetts region.

The University of Massachusetts Donahue Institute was hired by the city of Leominster primarily to develop and report research to address the following:

To define specific steps that might be taken to support the plastics industry in North Central Massachusetts.

To enable policymakers to "move the question" on whether and how the development of a regional plastics technology center is feasible.

From the inception of this study, the research team and the City of Leominster understood and agreed that the industry is regional and not confined to municipal borders. Although Leominster houses the largest concentration of companies among local municipalities companies—including major enterprises—are scattered throughout neighboring cities and towns in North Central Massachusetts. Accordingly, a credible analysis must be regional; thus, this research project has been based on a partnership among the City of Leominster, the North Central Chamber of Commerce, and the Plastics Council.

Methods

One component of our research effort was to interview plastics company executives in North Central Massachusetts. The interviews were used to directly determine needs of companies, to learn whether company executives believe that an industry center is the proper vehicle to meet those needs, and to gauge industry support for the center concept. More than fifty hours of

interviews were conducted with the leaders of twenty-six plastics companies in the region. Details of these interviews are presented in Chapter 3.

A second component of our research was an investigation of technology and training assistance centers across the United States. The goal was to learn how successful centers—especially centers that worked with plastics firms similar to the ones in this region—structured themselves, what their sources of funding were, and the extent to which companies were involved in their operations. Three types of centers were examined: (1) high-level research centers, which are most often housed on a university campus; (2) state-funded institutions, which are likely to broker a variety of services to several industries in a particular region of a state; and (3) regional–local centers, which often focus on a existing cluster of companies, located in a limited geographic region. The focus of these regional–local centers tends to be workforce development, with little, if any, technical assistance. Details of this investigation are found in Chapter 4.

Finally, to provide context for the two primary lines of investigation above, we conducted limited economic research to support the argument that private/public cooperation and coordination can enhance this important sector of the North Central Massachusetts economy. The results of this inquiry are reported in Chapter 2.

Major Findings

A. Availability and Utilization of Local Resources to the Industry

- A wealth of education, research, and training support is available to the companies of the North Central Massachusetts plastics industry. Within a 50-mile radius of Leominster, more than a dozen education and training institutions currently offer, or have the potential to offer, services to plastics companies. Within 150 miles of the region are an even more impressive array of vocational schools, community colleges, technical colleges, universities, and high-level plastics research centers. We would be hard-pressed to find a comparable region anywhere in the world.
- The vast majority of area companies are at least moderately aware of the range of programs and institutions that offer services to the plastics industry in the North Central region, particularly those targeted to workforce development. However, many companies do not use these resources effectively. Low utilization rates are commonly attributed to poor promotion of training by employers; the reluctance of shop-floor workers to participate; concerns related

to program content, schedule, or cost; and the fact that the marketing and outreach efforts of the Plastics Council to increase access to these resources are still maturing.

B. Attributes of Successful Industrial Centers

Of the three types of centers identified through this research, the model of a "regional–local center" appears best matched to the plastics industry in the North Central region. Successful regional–local centers frequently focus on the following:

- *Productivity enhancement*. Successful centers develop areas such as technology acquisition, financial management, product development, marketing, quality enhancement, and workforce education and training.
- *Group activities*. The overwhelming majority of centers that survive the start-up period combine single-firm activities with group activities such as workshops and seminars.
- *Small and medium-size companies*. These companies often face severe resource constraints. Successful centers have sought to reduce the risks and costs associated with adopting organizational and technical innovations, and they have distributed the expenses associated with training and education across a large number of enterprises.

The value these organizations provide to companies stems from five characteristics, which have important implications for the design and effectiveness of any center initiative that might take shape in the North Central region. Successful centers take on these roles:

- *Establish credibility with the employer community*. This characteristic is critical because employers will be reluctant to utilize the services of an organization they neither know nor respect. Strong executive leadership that holds the confidence of industry and the public sector is of paramount importance.
- *Identify problems and connect companies to the resources they need*. Whether the problems are in the area of technology or training, centers act as brokers, helping firms sort through options while reducing the costs associated with gathering information.
- *Catalyze tangible company-level change through on-site problem solving*.
- *Explicitly pursue collective learning strategies*. This role will expose the greatest number of firms to workplace innovations. This characteristic is critical because firms usually will not come together spontaneously.

- *Gain the trust of the business community*. For firms to commit to working with an outside organization they need to know the organization has staying power.

C. Industry Interest and Support for a Plastics Technology Center

- Half of all companies interviewed would support the development of a "limited" center housed within an existing organization. Eighty percent of interviewees would at least consider offering support for such a center. Support was strongest among the plastics molders we interviewed.
- At this time, there is little support among area companies for a "full-blown, bricks and mortar" technology center. Such a center is not considered sustainable.

D. Critical Needs Expressed by Members of the Plastics Industry

- Companies expressed a pervasive need for training and workforce development services, even while acknowledging that a lot of good content is available within the region.
- Several companies and key leaders within the plastics industry emphasized the need for enhanced or expanded secondary school programming to prepare young people to work in the industry.
- There is a lack of toolmakers and moldmakers within the region, which is attributable to the demise of apprenticeship programs in the 1960s and 1970s.

E. Special Concerns Regarding the Plastics Industry in North Central Massachusetts

- Small, locally owned enterprises, which typify the plastics industry in the North Central region, often lack the financial wherewithal to make the continuous investments in advanced equipment and workforce development that are necessary to keep their firms competitive in the global marketplace.
- The region's plastics industry has maintained a high degree of product diversification, even within individual firms. This diversification has most likely insulated the region from wild employment swings in the past. However, given that industry increasingly relies on technical engineering, design specialization, and rapid product life cycles, product diversification is not sustainable without requisite workforce skills and engineering support services.

Recommendations

A. Collaboration Among Major Stakeholders

1. **Establish an ongoing collaboration between the City of Leominster and the North Central Chamber of Commerce's Plastics Council.** Establishing this collaborative relationship is essential, regardless of whether a center is developed. Collaboration between these entities will provide a forum for development and implementation of strategic planning for the plastics industry and will be a nucleus for involving other regional industry and institutional stakeholders.

2. **Improve utilization of existing staff resources, rather than developing a capital-intensive plastics technology center**. An appropriate starting place would be improving coordination among staff of the City and the Chamber's Plastics Council, but this arrangement could also grow to include an actual merging of staff resources. If pursued, the development of an industry center should begin with an effort to better utilize these existing resources.

3. **Formalize cooperation and collaboration between the City of Leominster and the Chamber's Plastics Council through a Memorandum of Understanding.** This MOU should acknowledge that the effort is under direction of industry, but it should also emphasize that the City is a valued partner. A successful MOU would be a living document that should be used to attract other key institutions to the collaboration.

4. **Establish a predictable stream of state and federal funds for support of the plastics industry.** The City and the Chamber's Plastics Council should work with the Commonwealth of Massachusetts, its agencies, and legislators to secure ongoing funding to match the investments of industry and local government.

B. Initial Programmatic Efforts

5. **Improve the coordination of plastics-related training and education services within the North Central region.** A key step will be development of another Memorandum of Understanding that creates specific expectations of service providers and industry. The Plastics Council, through its training consortium, is well positioned to assume a leadership role in this effort.

6. **Maintain or expand existing mechanical engineering and machining skill training programs.** Our findings clearly indicate that workforce training and education needs are the galvanizing issue for this industry today. The City and the Chamber's Plastics Council should maintain these programs and seek to attract young people to them.

7. **Develop an executive seminar series to explore the long-term future of the plastics industry.** Topics may include key management issues, marketing assistance, and technical innovations. The City, the Chamber, and the Plastics Council should work with firms such as NYPRO and Netstal to develop content and guidance for this effort. In addition to inviting industry executives, these seminars should welcome executives from other key organizations in the North Central region, such as mayors and leaders of educational institutions.

8. **Immediately establish and maintain a public time line for implementation of these recommendations.** Acknowledgment and adherence to a public time line will help to maintain critical momentum for this effort. MassPLASTICS 2000 in late October 2000, is an appropriate time for the City and Chamber's Plastics Council to report on progress through October 1, 2000, in all action steps.

Chapter 1
Introduction

A recent *Boston Globe* article proclaimed that the plastics industry, which is rooted in Massachusetts, has reinvented itself with new products, customers, and technology. For years the industry churned out mundane products like sunglasses, combs, and pink flamingos. Now it makes sophisticated products like cellular phones, laptop computer casings, and medical devices (Diesenhouse, 1998). At the present time, the state's plastics industry is being remolded, and in the Leominster-Fitchburg region, change is taking place at breakneck speed. The question is, would the creation of a publicly sponsored, industry-led organization that provided technical education and training, as well as business services to firms, enhance this process and thus ensure the sustainability of plastics manufacturing in the region?

Historically, the City of Leominster has been a leading center in the plastics industry in Massachusetts as well as within the northeastern United States. The City retained a research team from the University of Massachusetts[1] to investigate how the city could best support the local plastics industry. Leominster was particularly interested to determine if it is feasible to develop a regional technology center to serve plastics manufacturers in North Central Massachusetts.

In our approach to this project, we wanted to overcome a standing "build it/don't build it" argument with respect to a plastics technology center, as we believed that was too limited a perspective to take on the broader issue of how best to support the industry.

As our research progressed, we began to emphasize the need for coordination starting between the Plastics Council and the City of Leominster, and then expanding that circle to include other public and nonprofit entities in the region, as well as plastics companies that are not active in the Council.

Our Research Methods

From the outset, we framed this work as an industry-based study, and our primary investigation was along two lines of research. First, we conducted structured interviews with twenty-six chief

[1] The research team consisted of staff from the UMass Donahue Institute and faculty from the University's Center for Industrial Competitiveness at its Lowell campus.

and senior executives of plastics companies in North Central Massachusetts (reported in Chapter 3). We asked them about their opinions of a plastics technology center, the problems they face trying to maintain and grow their businesses, and how they saw the most productive ways that a coordinated private/public effort could help the industry. In addition, we spoke formally and informally with others in the region who have been active in supporting the regional plastics industry, including representatives of nonprofit and educational institutions.

For the second major focus of this study, we examined models nationwide of industry centers in operation (reported in Chapter 4). We looked at how industries support those centers and participate in the centers' activities, as well as how the centers are organized and financed. From this analysis, we gleaned important lessons for Leominster and the rest of North Central Massachusetts on how various successful centers operate and how to identify and nurture building blocks for a viable industry center.

As an additional line of investigation, we conducted an economic analysis to measure the vitality of the local plastics industry against national trends and trends in key plastic industry centers across the nation (summarized in Chapter 2). The economic research is meant to provide a context for the argument that private/public cooperation and coordination can enhance an important sector of the North Central Massachusetts economy.

To develop our analysis and recommendations, we brought together the core components of this study, the industry interviews and centers analysis, to determine the following:

- Specific steps that might be taken by the city to support the local plastics industry.
- The North Central Massachusetts plastics industry would support developing a stand-alone center at this time, and how much support industry would contribute to such a center.
- What constraints are facing the industry, which stand to impede future growth, and what realistic strategies are available to address those constraints, if it appears that there is not sufficient support to construct a standalone plastics technology center at this time.
- How successful industrial centers have been established and operate and which of these lessons may be exportable to the plastics industry of North Central Massachusetts, given the perspectives of company executives at this time.

Moving the Question

The plastics industry in North Central Massachusetts has been a subject of continuous study and debate for more than ten years, with much of the debate focused on developing an industry center. Our effort is targeted to moving the discussion forward by building on the foundation established in past efforts, including an array of studies by university professors, consultants, local officials, and regional planners.

The following is a list of studies and documents of the plastics industry and of a prospective plastics technology center in the City of Leominster and North Central Massachusetts that date from 1987 to1999. We have built our work on these efforts and have consciously avoided duplicating this work. Many of these titles are also cited as references at the back of this report.

Feasibility Study for the Center for Plastics Technology, Leominster, Massachusetts, Mullin, John R. 1987.

State of the Plastics Industry Report, Murray, Edward P., and Mory, Kristin, 1997.

A Contextual Analysis of the Spatial Concentration and Organization of Production of the Plastics Industry in North Central Massachusetts, Murray, Edward P., Ph.D. Dissertation, 1996.

Best Practices: A Plastics Manufacturing Partnership, Darewent, Claire M., 1997.

Plastics Technology Center Business Plan, City of Leominster, 1998.

Plastics Profile: An Overview of the Plastics Industry in North Central Massachusetts, Cluster-Based Development Strategies: Lessons from the Plastics Industry in North Central Mass, Murray, Edward P. 1999

Chapter 2

The Plastics Industry

At the end of 1999 there were approximately 700 plastics companies and related firms in Massachusetts. Related firms include specialized and highly skilled moldmaking companies, equipment manufacturers, and resin and material suppliers. According to a recent Society of Plastics Industry report, Massachusetts has the seventh-largest concentration of plastics companies in the United States and is well behind the top two states, California and Ohio (with 2,100 and 1,200 firms, respectively). By employment, the state ranks twelfth in the nation.

Employment statewide has risen steadily from the early 1990s—when it was slightly over 30,000—to 42,000 at the end of 1998. The industry has an annual payroll of just over $1 billion. Twenty-five to 30 percent of jobs, payroll, and firms are in North Central Massachusetts. The Commonwealth's plastics exports increased to $448 million in 1998 from $379 million in 1993. Exports were just $212 million in 1988.

A comparison of third-quarter 1998 and third-quarter 1999 iMarket data reveals that there was a slight drop in the total number of plastics firms in North Central Massachusetts, from 172 to 158. There was also a loss of 126 jobs. Over the same period, industry sales increased to $864 million from $850 million.

What Does the Industry Look Like?

Companies are in three distinct market segments:

- Packaging, including plastic bags, especially for food processors and in the manufacture of items like foam packing materials;

- Specialty products, mainly for the aircraft, computer, medical, and telecommunications industries; and

- High-volume commodity products, such as cosmetics tubes, dinnerware, and disposable bowls, cutlery and cups.

Significant numbers of firms in each segment are found in cities across the state, with particularly large groupings of firms in Greater Pittsfield, Leominster-Fitchburg, and Greater

Lowell. There is a large group of metalworking firms across Massachusetts that produce molds, tooling, and moldmaking machinery for the industry. In one study of the North Central Massachusetts plastics cluster, it was determined that of the 176 firms in the region, close to 40 percent made tools, dies, molds, and industrial machinery. While most of these firms are not dedicated to the plastics industry, a weakening of plastics in the region and across the Commonwealth will have negative impact on such firms (Plastics Technology Center Steering Committee, 1998). Rounding out the industry is an important group of large firms like Gillette and Millipore that, while not classified as plastics companies, indeed make things out of plastic, and thus rely on the expertise of molders, moldmakers, and plastics engineers for their success.

General Characteristics of the Industry in North Central Massachusetts

In *The State of the Plastics Industry Report* (1997) it was determined that there were 176 plastics and related firms in North Central Massachusetts. Based on late-1999 data, that figure is nearly the same today. This falls short of an estimate made by the Plastics Technology Center Steering Committee in 1998 that there would be more than 200 firms in the region by 2000. Rather than substantial growth over the past few years, the industry has merely managed to hold its own in terms of firms and employment.

Based on numerous surveys the following general profile of firms can be established:

- Firms average 45 employees, with the largest number of firms employing from 21 to 50.

- An extremely high percentage of firms originated in the region (95 percent in one survey). This fact is indicative of a strong commitment to the region as well as a substantial process of start-ups and spin-offs based on local entrepreneurial skills.

- Related to the above point, 70 percent of firms are locally owned and operated. This figure helps to explain the high degree of industry involvement in various efforts to establish a plastics technology assistance center. Since deindustrialization in industry sectors is often hastened by sudden ownership shifts, this high percentage of local ownership should be construed as a positive indicator. However, the recent acquisitions of some larger firms suggests that this local ownership pattern may be changing.

- It is the case that small, locally owned enterprises often lack the financial wherewithal to make the continuous investments in equipment and workforce development necessary to

keep their firms competitive in the global marketplace. This situation is evidenced by a statewide finding that firms spend less than 3 percent of total sales on research and development, thus hampering new product development.

- A 1998 statewide plastics industry survey determined that, based on sales, the top markets for firms included the automotive/transportation, electronics, and medical industries, followed by custom processors and manufacturers of packaging and bottles (Massachusetts Technology Collaborative, 1998). Within the region there remains a high degree of product diversification, even within individual firms. While this product diversification has most likely insulated the region from wild employment swings, there is a cautionary note here. In an era of increased technical engineering and design specialization, as well as rapid product life cycles, firm diversification—without the requisite skill base and engineering support services—is not sustainable. Important markets include medical equipment, housewares, and electronics (MTC, 1998).

- Firms that produce housewares were identified in one survey as the most important customer of Leominster area enterprises. Medical suppliers, electronics firms, and auto manufacturers were listed as the next most important (Murray and Mory, 1997). Statewide, plastics firms indicated in a 1998 survey that top customers were the automotive, electronics, and medical sectors (Massachusetts Technology Collaborative, 1998). Thus, the overall strength of the state's plastics industry combined with general manufacturing is important to the long-term success of area plastics companies.

- With the exception of a handful of large firms, the region's plastics companies export very little, and the smaller the firm, the less likely it is to export at all. According to the Massachusetts Technology Collaborative, only 7.55 percent of plastics industry sales are going to markets outside the United States, and although this represents an increase from 5.36 percent in 1994, it remains quite low. Indeed, the customer base of Greater Leominster firms remains concentrated in New England and along the East Coast, with a significant concentration in Massachusetts and greater-Leominster.

The Industry Support Structure

A. Engineering and Design Support

Across the state there are approximately 150 companies that build machines and produce needed components like molds, tools, dies, instruments, and controls for plastics firms. Why is this important? These plastics-related enterprises often are not considered when local, state, and federal policies are constructed to support the plastics industry. The firms, however, play an extremely important role in the success of plastics firms, and in turn, the growth of plastics firms pushes growth within the industrial support sectors as well. Moldmakers produce a variety of precisely engineered molds and tool and die components for injection molding and molded products firms.

In the Massachusetts Technology Collaborative's statewide survey, it was determined that 86 of 114 respondents (75 percent) engaged in injection molding. Thus, access to, and the quality and reliability of molds, contributes a great deal to whether companies produce high-quality parts for their customers. T he creative process between plastics firms and moldmakers in the design of molds for new products is vital to the long-term ability of local companies to shape their own proprietary products. Any weakening of this mechanical engineering and machining skill base will have widespread, negative implications for the entire plastics industry; thus, special attention must be paid to machinist education and training by any center that is established.

B. Education, Research, and Training Support

Massachusetts is home to several research centers that engage in such enterprises as new materials development, mold and materials analysis, nondestructive material and product testing, and new product design. The University of Massachusetts has two campuses with plastics research and development and process engineering capabilities, and thus plays an important role within the plastics industry support structure. The Amherst campus is home to the Center for Research on Polymers, one of the strongest polymer research centers in the world. There, important basic research is done on such items as new materials. The Lowell campus has the largest accredited plastics engineering department in the country and is home to the Biodegradable Polymers Research Center. Faculty from both campuses receive substantial National Science Foundation funding, while both research centers receive financial support from several industry partners. Finally, within an approximately 50-mile

radius of Leominister there are over a dozen education and training institutions that today offer, or have the potential to offer, services to firms in the region.

In addition to the two state university programs, education and training institutions include the NYPRO Institute, the Center for Technical Education in Leominster, Montachusett Regional Vocational Technical High School in Fitchburg, Mount Wachusett Community College in Gardner, Fitchburg State College, Worcester Polytechnic Institute, the National Plastics Center and Museum, Plastics Technology Training Consortium, and Twin Cities Community Development Corporation. This extensive grouping of producers, supportive firms, and engineering, technical services, and training providers—superbly inventoried in the 1997 report *Best Practices: A Plastics Manufacturing Partnership* by Claire Darwent—represents a large, statewide, and nascent plastics network.

Why does access to this technology infrastructure and to education and training institutions matter? The 1998 MTC survey determined that finding qualified workers and training incumbent employees were the two most important human resource issues confronting plastics firms in the state, followed by improved managerial education. In their 1999 report, Mass Insight concluded that while there are fewer manufacturing jobs in the Commonwealth, manufacturing is the "principal source of productivity growth" in the state economy (Mass Insight, 1999, p. 6). Today, the high-wage, high-skill jobs that remain in manufacturing comprise 74 percent of the economic base of what Mass Insight refers to as Outer Massachusetts, the regions of the state beyond Greater Boston. These jobs rely on highly skilled workers, and based on growth projections in medical equipment, telecommunications and computer hardware, and biotechnology, there is an opportunity for plastics firms to expand their customer base, but only if workforce and managerial skills continuously improve (Plastics Technology Center Steering Committee, 1998, p. 13).

Challenges Before the Industry

A 1995 study of the plastics industry by University of Massachusetts Lowell Professor Michael Best notes that the ability to access research and development and engineering expertise is crucial to plastics firms, as materials and processes continuously evolve and as environmental concerns pressure the industry to develop biodegradable materials. Therefore, the long-run success of the state's plastics firms is predicated on their ability to develop new products quickly; make the transitions required to work with new materials and meet more

stringent environmental standards; and train a next generation of employees capable of utilizing state-of-the-art equipment and participating in a continuous shop-floor innovation process.

The importance of a skilled workforce is echoed in other states with high concentrations of plastics firms. For example, in Pennsylvania, in a state-sponsored study of the plastics industry, a firm owner reported that the core issue for growth is “training and education of the workforce.” The report noted that across the state it is difficult to find good people—not only for the lower-skill jobs, but for the high-skilled jobs as well. Thus, the research and technical support available to the state’s plastics firms is crucial to their long-term success, for each market segment is faced with numerous environmental and competitive pressures. Most lacking in Pennsylvania are all-around processing and machine maintenance workers. In addition—identical to the Commonwealth’s situation—there is here is an alarming lack of toolmakers and moldmakers, attributable to the demise of apprenticeship programs in the 1960s and 1970s.

Another important issue for firms is the ongoing debate over waste disposal. In packaging, for example, this debate has significant market implications for local firms. Throughout Europe more stringent recycling requirements make it imperative that Massachusetts firms seeking a market there gain access to new materials in a timely manner. For commodity producers—those that turn out disposable plastic dinnerware, for example—the threat from low-cost imports is severe. For specialty producers, the ability to work to ever higher quality standards, provide design and engineering services to customers, and ship in a just-in-time environment are just a few of the challenges. In all cases, the resolution of problems grows from an ability to design and maintain molds, make quick changeovers from one product to another, and continuously improve manufacturing processes to be a cost-effective provider of products in the global market.

The Importance of Shop-Floor Skill

A company's skill base determines the product markets in which it is able to compete and the process technologies that constitute the value chain under its control. How and where a company chooses to invest in its skill base also affects the quantity and quality of employment opportunities in the geographic regions where those skill-base investments are made. Of potentially significant importance to a company in its strategic decisions to invest in

a skill base in a particular region is the process of skill formation that the regional environment supports. And central to a regional process of skill formation are the strategies and structures of regional technology universities.

Just as the research and development demands placed on plastics firms have been ratcheted upward, so too have the skills requirements of frontline workers. In many plants, employee teams are now charged with responsibilities that have long been the purview of supervisors and managers. It is no longer sufficient for a worker simply to tend an injection molding machine. In-process quality checks are made to ensure that scrap rates are kept to an absolute minimum. The changeover times on equipment, in order for the machines to produce a range of products efficiently, must be continuously shortened to meet shipment deadlines and keep customers happy. Equipment is outfitted with state-of-the-art heat sensors and other high-tech devices—designed to help maintain a high level of material quality—that need to be monitored. Long gone are the days when workers stood with sharp knife at the ready to cut the excess plastic away from parts spewing forth from injection molding machines. Today, operators have to be involved in the determination of why the excess material is there in the first place!

While it is indeed the case that Massachusetts has set world-class standards in its support for both the more advanced research and development and the engineering needs of the plastics industry, we have not done nearly as well in the preparation of twenty-first-century frontline employees. Mold design and moldmaking, for example, require critical hands-on and conceptual skills that take years to learn. Both groups of workers are vital to the new product development process, and thus play a pivotal role in helping to maintain globally competitive Massachusetts firms. However, moldmakers should have “endangered species” status, and this dearth of skill will surely chill the advance of “smart plastics manufacturing.”

Firms that function under strong competitive pressure and in demanding markets are compelled to push ahead with product improvements and new products as fast as possible, and in so doing they will inevitably encounter organizational and technical problems that they do not know how to solve. A well-coordinated infrastructure of firms and institutions can help to resolve these issues. The capacity of an industry or a regional economy to provide well-paying jobs and a broadly shared sustainable prosperity is contingent on the ability to learn new things and resolve problems

as they manifest themselves, and a systematic learning process among enterprises and institutions can help to make this happen.

In “Toward the Learning Region,” Richard Florida (1995) outlines the shift to knowledge-intensive capitalism and makes the case that each firm needs a broader knowledge infrastructure than simply its particular individual firm if it is to keep up with the shortened product and technology cycles that exist today. Florida explains that learning regions require an infrastructure of knowledge workers who can apply their intelligence to production. The education and training structure must facilitate lifelong learning and provide the high levels of group orientation and teaming required for knowledge-intensive economic organization (Florida, pp. –533–534).

Chapter 3

Company Interviews: A Summary of Findings

This section summarizes the findings of in-depth interviews with plastics-related companies in the North Central Massachusetts region. It is organized into three subsections: an introduction and methodology; a high-level overview of key findings; and a quantitative presentation of interview findings.

Introduction and Methodology

A. Background

The overarching objective of this project was to enable policymakers to "move the question" on whether the development of a regional plastics technology center is necessary and feasible. From the inception of this study, it was clear that research into this question should draw heavily on the input of members of the North Central Massachusetts plastics industry.

To ensure adequate industry focus, an extensive company interview process was implemented. This process relied on a structured interview protocol that ascertained that the perceptions and opinions of industry leaders were collected in an impartial and systematic manner. More than fifty hours of interviews were conducted with the leaders of twenty-six companies that are members of the region's plastics industry.

To validate the interview findings contained in this final report, they were presented to an independent group of eleven industry executives on January 14, 2000. In that forum, also attended by staff of the City of Leominster and the North Central Massachusetts Chamber of Commerce, the findings were publicly validated as accurate and consistent with the perceptions of industry members in attendance.

B. Selection of Interview Candidates

The North Central Massachusetts Chamber of Commerce's *Plastics Profile* identifies 141 "plastics and related companies" within the region. This guide was used to determine sampling requirements for the interview process. At the inception of the study, it was decided that staff of twenty to twenty-five companies would be interviewed and that this sample should be generally

representative of the industry in terms of the geographic location, Standard Industry Classification (SIC) codes, and employment of companies.

Rather than sampling randomly from the population of companies in the *Plastics Profile*, the City of Leominster and the Chamber were each asked to suggest a list of companies and contacts to participate in the interview process. The sampling process ensured that the City and the Chamber had an equal number of their suggested interviewees included in the process. It also helped to ensure that the interview sample encompassed a substantial number of companies and individuals who are engaged in local initiatives that support the plastics industry.

Analysis of the sample of interviewed companies is presented in the section headed "Profile of Interviewed Companies."

C. The Interview Protocol

To maintain consistency among interviews and ensure that the information needs of the research project were fulfilled, a structured interview protocol was developed. This protocol was not a rigid interview script. Rather, it was a road map for an open discussion of the needs and resources of the plastics industry and of industry interest in a plastics technology center. The interview protocol addressed the topics listed below:

- Company profile (products, processes, workforce, and markets)
- Critical business issues
- Awareness of supportive resources
- Utilization of supportive resources (emphasis on local resources)
- The role of local government as an industry resource
- The need for a plastics technology center
- Interest in or support for a technology center
- Willingness to pay for center services
- Center leadership
- Center location or host organization

Overview of Key Findings

This section summarizes the most relevant and pervasive themes that emerged from the in-depth interview process. These findings encompass the opinions and perceptions shared by leaders of twenty-six plastics-related companies that are broadly representative of the plastics industry in the North Central Massachusetts region. These findings were further validated by an independent panel of eleven industry executives, which was convened by the City of Leominster and the North Central Massachusetts Chamber of Commerce on January 14, 2000.

A. Critical Needs of Plastics-Related Companies

- Companies expressed a pervasive need for training and workforce development. Common subthemes included the need for training and education of incumbent workers and the available workforce, but also emphasized the need for enhanced secondary school programming to prepare young people to work in the industry.

- The training and workforce development needs expressed by different types of plastics-related companies are unique. Training and workforce solutions must consider the range of specific needs of plastics-related companies.

B. Awareness and Use of Local Resources Available to the Industry

- A review of education and training resources in the North Central Massachusetts region reveals a wealth of supportive programs and institutions.

- The vast majority of companies are at least moderately aware of the range of local programs and institutions that offer services to the plastics industry.

- Overall, company utilization of local resources is lower than many industry and program leaders would like. Managers of some companies expressed concern that shop-floor workers are not willing to participate in training. Program leaders indicated that some employers say they want training, but do not effectively promote it among employees.

C. Industry Support for a Plastics Technology Center

- Half of all companies interviewed would support the development of a limited center. Four-fifths of interviewees would at least consider offering support for such a center. Support was strongest among the molders we interviewed.

- Interviewees were divided and often unsure whether a plastics technology center is needed to support the region's plastics industry. Among interviewees, molders most frequently indicated that a center is needed.

- Nearly half of interviewees indicated they would pay for the services of a center. These companies would consider either fee-for-service or membership arrangements.

D. Industry Vision of a Plastics Technology Center

- At this time, there is little support among companies for a "full-blown, brick and mortar" technology center. Such a center is not considered sustainable.

- To the extent that center offices or other facilities are needed, they should be co-located with an existing program or institution. This arrangement would help keep costs low.

- If pursued, the development of a center should begin with an effort to better utilize existing staff resources of the City and the Chamber. These staff would help to coordinate and increase utilization of existing education and training resources.

- If a center is to be developed, it should coordinate and enhance, rather than duplicate, existing services. This effort will improve efficiency and ensure that local programs are complementary rather than competitive.

- If developed, expansion of a center should be incremental. The cost and demand for new services should be fully understood before resources are committed.

- To maintain industry support, the center and its activities must be substantially directed by members of industry.

- The leadership of a center or other related initiative should be collaborative, engaging the energies of government, industry, and the Chamber of Commerce. The center should also

have a strong executive director who is broadly respected by industry and can effectively champion the mission of the organization.

- At present, there are a limited number of people active in efforts to support the plastics industry. The limitations of this existing resource base must be recognized and strategies developed to ensure that individuals are not overtaxed to the detriment of existing programs and services.

E. Industry Opinions on the Appropriate Role of Government

- The most frequently cited priority for government action was increased support for vocational secondary education, especially those disciplines that relate to the plastics industry.

- With direction from industry, government should provide staff or other assistance to coordinate and enhance the array of education and training resources found in the North Central Massachusetts region.

- Government should pursue policies that are in the best economic interests of the plastics industry and the region.

Quantitative Presentation of Interview Findings

This section presents all relevant findings of the company interview process in a quantitative format. This quantitative perspective was derived through a thematic analysis of the opinions and perceptions shared by leaders of twenty-six plastics-related companies that are broadly representative of the plastics industry in the North Central Massachusetts region. These findings were further validated by an independent panel of eleven industry executives, which was convened by the City of Leominster and the North Central Massachusetts Chamber of Commerce on January 14, 2000.

The specific topics covered in this section are presented in the approximate order that they were discussed during company interviews. This sequencing allowed the conversation to develop from its base in the company and its needs, then move outward to include a discussion of industry resources and the broader topic of how government can best support the plastics industry. The sequencing of this section is as follows:

A. Profile of interviewed companies
B. Plastics industry needs
C. Awareness and use of local resources available to the plastics industry
D. Industry vision and support for a plastics technology center
E. Industry priorities for government action

A. Profile of Interviewed Companies

The City of Leominster and the North Central Massachusetts Chamber of Commerce were asked to provide lists of companies they would advise the researchers to interview. The City and the Chamber were asked to consider several factors as they compiled their lists, including the SIC code, employment, and geographic location of companies. The past involvement of the company in industry-related initiatives of the City or Chamber was also an important consideration. Sample variance analyses, as well as a profile of the companies interviewed, appear in this section.

Overall, leaders of twenty-six companies were interviewed, based on data contained in the Chamber's *Plastics Profile*; this segment represents 18 percent of all plastics-related companies in North Central Massachusetts. Interviewees most frequently included owners, presidents, and directors of human resources.

SIC Code and Business Activity

Table 1 presents the number (*n*) and proportion (percent of sample) of interviewees by SIC code. It also displays the proportion of companies in the region by SIC code, as well as the variance (difference) between the interview sample and the total population.

Overall, the SIC codes of the companies interviewed is highly representative of the distribution of SIC codes in the total population of plastics-related companies in North Central Massachusetts.

Table 1

Interview Sample Review: SIC Code

		n	% of sample	% of region	% variance
2821	Plastics materials	2	8	10	-2
3089	Miscellaneous plastic products	15	58	61	-3
3544	Special dies and tools	8	31	25	6
3559	Special industry machinery	1	4	3	1

An SIC code is a useful descriptor of the nature of a company's business, but it can also sometimes be misleading. Table 2 describes the interview sample in terms of the fundamental activity of the business, as identified by company staff. No reliable comparative data were available for the region.

Almost two-thirds (65 percent) of the companies interviewed have molding operations, 38 percent have moldmaking operations. Nearly one-fifth of interviewed companies are dual process, with both moldmaking and molding operations.

Table 2

Interview Sample Review: Business of Company

	n	% of sample
Molder	12	46
Moldmaker	5	19
Molder and moldmaker	5	19
Materials	2	8
Equipment sales	2	8

Company Employment (Full-Time Equivalents)

Table 3 presents the number (*n*) and proportion (percent of sample) of interviewees by level of employment (in full-time equivalents, or FTE). It also displays the proportion of companies in the region by FTE, as well as the variance (difference) between the interview sample and the total population.

With regard to employment, the sample of interviewed companies is not proportionally representative of the industry as a whole. One cause of this imbalance is that moldmakers tend to be small companies, while molders tend to be larger. There are also more molders than moldmakers in the region. As a result, if molders and moldmakers are sampled proportionately, the overall sample will be skewed toward larger companies.

The positive side of this oversampling of larger companies is that the interview process engaged companies that represent a greater proportion of total plastics industry sales and employment than would otherwise have been the case. On the negative side, some concerns unique to very small companies may be underemphasized in these findings.

Table 3

Interview Sample Review: Company Employment (FTE)				
Number of Full-Time Employees	*n*	% of sample	% of region	% variance
1 - 10	4	15	35	-20
11 - 25	3	12	17	-5
26 - 50	10	38	22	16
51 - 100	2	8	11	-3
101 - 250	3	12	10	2
> 250	4	15	5	10

Company Location

Table 4 presents the number (*n*) and proportion (percent of sample) of interviewees by geographic location. It also displays the proportion of companies in the region by location, as well as the variance (difference) between the interview sample and the total population.

The location of companies in the interview sample is generally representative of the concentrations of plastics-related companies within the region. The greatest proportion of plastics-related businesses operate in the City of Leominster, with lesser concentrations in other communities. It should be noted that among "All others," only Sterling is home to more than four plastics companies. Fourteen communities with fewer than five plastics companies each are counted under "All others."

Table 4

Interview Sample Review: Company Location				
	n	% of sample	% of region	% variance
Leominster	18	69	57	12
Fitchburg	2	8	16	-8
Clinton	2	8	5	3
All others	4	4	22	-18

Source of Nomination

Table 5 presents the number (*n*) and proportion (percent of sample) of interviewees by the source of their nomination into the interview process. This variable was monitored to ensure that the

sample did not reflect a particular bias due to any presumed affiliation with either the City or the Chamber.

The source of nominations within the interview sample is evenly balanced. The greatest proportion of companies was common to both the City and the Chamber nomination lists. One company was added to the sample at random to adjust for the underrepresentation of very small companies among the nominations. The experience of interviewing this randomly selected company underscored the wisdom of utilizing lists of recommended interviewees; the company is only marginally related to the plastics industry.

Table 5

Interview Sample Review: Nomination Source

	n	% of sample
Common to City and Chamber	10	38
Chamber of Commerce	8	31
City of Leominster	7	27
Random	1	4

B. Plastics Industry Needs

Interviewees were asked to consider the factors that most constrain their company as it pursues its business goals (Table 6).[2] While responses touched on several themes, the need for training and workforce development was pervasive. Common subthemes included the need for training and education of incumbent workers and the available workforce, but also emphasized the need for enhanced high school programming that would impart technical skills to young people and prepare them to work in the plastics industry. Interviewees consistently indicated that if some type of plastics technology center is created, it should focus on workforce development issues.

[2] Interviewees were permitted to express more than one concern. For this reason, the number of themes expressed in Table 6 exceeds the number of interviews conducted.

Table 6

Company Needs and Desired Services*

Theme	Total
Training	35
Modernization	4
Unskilled labor crunch	4
Foreign competition	3
Public relations	2
Quality control	2
Technical assistance	2
Cost of manufacturing space	1
Financing	1
Small size	1

* As cited during company interviews.

Table 7 articulates the distinct needs expressed by molders and moldmakers. It is clear that these two types of businesses have vastly different training requirements, a point that was emphasized by several interviewees. Materials and equipment companies also articulated unique business needs.

Viewing Table 7, it is important to recognize the emphasis on shop-floor and supervisory skills, as opposed to higher-level engineering and management skills. It should be noted that companies that sell machinery and materials most frequently conveyed a need for improved technical and sales skills among staff.

Table 7

Detail of Training Needs*

Molders	Total
mold technicians	11
machine operators	6
ESL	3
supervisors	3
process engineers	2
computer skills	1

Mold Makers	Total
CNC/CAD	2
Trade Skills	2

* as cited during company interviews.

C. Awareness and Use of Local Resources Available to the Plastics Industry

A review of education and training resources in the North Central Massachusetts region reveals a wealth of supportive programs and institutions that are available to members of the plastics industry. This study was not intended to update or reassess past studies that described these resources in detail[3]. This study does, however, address company awareness and utilization of local resources.

Most Frequently Cited Resources

Among the broad range of organizations that provide education, training, or other technical services to the plastics industry, a select group was consistently mentioned during interviews. Below, these frequently cited resources are grouped into three broad categories: institutions of secondary education; colleges and universities; and private and governmental organizations. The resources to the plastics industry most frequently identified by interviewees include:

Secondary Education

- Center for Technical Education at Leominster High School
- Montachusett Regional Vocational Technical School

[3] *Best Practices: A Plastics Manufacturing Partnership* (October 1997) by Claire Darwent offers a comprehensive and generally current inventory of education and workforce development initiatives, as well as business and governmental institutions, that are potential resources to the plastics industry in North Central Massachusetts.

Colleges and Universities

- Mount Wachusett Community College
- University of Massachusetts Lowell
- Fitchburg State College

Private and Governmental Organizations

- North Central Massachusetts Chamber of Commerce
- NYPRO Institute
- Materials and equipment suppliers
- Customers and subcontractors
- Montachusett Opportunity Council
- Private consultants

Awareness of Local Resources

Company awareness of locally available resources to the plastics industry was examined through the interview process. To provide a quantified overview of the qualitative responses provided by companies, three general "awareness levels" were created, and companies were coded into one of these three categories based on the information they revealed during their interviews. The breakdown of companies that fall into each of the three levels (low, moderate, and high awareness) is displayed in Table 8.

Overall, data indicate that the vast majority of companies (22 of 25) have at least a moderate awareness of local programs that serve the plastics industry. The highest level of awareness was generally found among companies with dedicated human resources staff and among members of the Chamber's Plastics Council. Subgroup details (presented in Table 8) should be considered with caution due to small sample sizes.

Table 8

Awareness of Local Education and Training Resources

Group	n	Awareness*		
		low	moderate	high
All Companies	**25**	**12%**	**28%**	**60%**
Molders	12	8%	33%	58%
Mold Makers	5	0%	40%	60%
Molders/Mold Makers	5	20%	0%	80%
Others	3	33%	33%	33%

* of the range of local resources mentioned during interviews

Utilization of Local Resources

As the development of a plastics technology center is discussed, company utilization of existing local resources is a particularly important consideration. Again, three categories (low, moderate, and high utilization) were used to characterize the behavior of companies. Companies that did not use local resources (excepting customers or suppliers) were categorized as "low"; companies that indicated use of one or more resources were classified as "moderate" or "high" depending on the extent of use they indicated for each program or institution.

Overall, data in Table 9 show that the utilization of available resources is mixed, with nearly equal proportions of companies classified as low, moderate, and high. It should be noted that equipment and materials companies, which comprise the "Others" grouping, were all classified as low in utilization. This response is probably due in part to the emphasis of local programs on the needs of molders and moldmakers, which are the largest segments of the region's plastics industry.

Again, companies with dedicated human resources staff tended to report higher utilization of available services than did other companies. Some very small companies indicated low utilization of local resources, reportedly due to the excessive workloads of managers who make training and education decisions.

A trend that emerged across all companies is the concern of managers that shop-floor workers are not willing to participate in training. This factor was cited as one of the greatest barriers to program utilization. On a related note, few companies offer work release time for off-site training of shop-floor employees. Many people involved in developing local training programs are concerned that some employers say they want training, but do not put sufficient effort into promoting training among their employees.

Table 9

Utilization of Local Education and Training Resources

Group	*n*	Utilization		
		low (%)	moderate (%)	high (%)
All companies	**25**	**36**	**36**	**28**
Molders	12	25	33	42
Moldmakers	5	40	40	20
Molders/Moldmakers	5	20	40	40
Others	3	100	0	0

Range of local resources utilized, as identified during interviews.

D. Industry Vision and Support for a Plastics Technology Center

At the heart of this study lies the question "Does the plastics industry support the development of a plastics technology center?" This question must be supplemented by at least two other questions: "Does the region really need a center?" and "Would companies be willing to pay for the services a center might provide?"

This section provides industry responses to those questions. These responses are preceded by a summary view of what some members of industry suggest is a viable vision of a center and its leadership structure.

Interviewees shared a number of compelling opinions and recommendations regarding the potential development of a plastics technology center. Significant themes that were widely mentioned are reported under "Key Findings" above (pages 20-21). The following expands on those themes.

Center Leadership

There was broad agreement among interviewees that if a viable center is to be created it must be industry led. However, there was also a general agreement that to be effective a center would need to bring together the energies and efforts of industry, local city governments, and non-governmental resources such as the Chamber of Commerce. As one interviewee noted, "Today's challenges require that these groups put aside their differences" in favor of collaboration.

Based on interviews conducted with staff of companies, resources, and the City, it appears that all sides recognize a need to collaborate and that such collaboration is viable.

Political Support for a Center

Many interviewees expressed interest in the establishment of a plastics technology center (Table 10). Overall, 80 percent indicated they might support plans to create a center. Support appears strongest among molders, although subgroup sample sizes are small and differences should be considered with caution.

Table 10

Company Support for Center Concept

Group	*n*	Response*		
		Yes (%)	Maybe (%)	No (%)
All Companies	**25**	**48**	**32**	**20**
Molders	12	75	17	8
Moldmakers	5	40	20	40
Molders/Moldmakers	5	0	60	40
Others	3	33	67	0

* As identified during interviews

Need for a Center

Overall, interviewees were divided and often unsure whether a plastics technology center is needed to support the region's plastics industry (see Table 11). Subgroup data indicate that among interviewees, molders most frequently (58 percent) believe a center is needed. On the other hand, 60 percent of the moldmakers interviewed indicated that a center is not needed. It may be important to note that some of these moldmakers are members of the Chamber's Plastics Council Education Consortium. This fact might make them protective of the consortium's training and education efforts. It might also make them better informed than other companies of the programs currently available to the industry. Again, subgroup sample sizes are small, and this data should be considered with caution.

Table 11

Perceived Need for a Center

Group	n	Response*		
		yes	no	unclear
All	**25**	**36%**	**28%**	**36%**
Molders	12	58%	8%	33%
Mold Makers	5	20%	60%	20%
Molders/Mold	5	0%	20%	80%
Others	3	33%	67%	0%

* as identified during interviews

Company Willingness to Pay for a Center

Interviewees were asked whether they would be willing to pay for the services of a center, if that center was responsive to the particular needs of their company. About one-half of responding interviewees indicated they would pay for the services of a center. Fee-for-service arrangements, at or below standard consulting costs, were the most frequently cited arrangement. Many companies were also open to corporate memberships.

Table 12

Willingness to Pay for a Center

Group	*n*	Response*		
		Yes (%)	No (%)	Uncertain (%)
All Companies	**21**	**48**	**48**	**5**
Molders	12	50	42	8
Moldmakers	3	0	100	0
Molders/Moldmakers	4	50	50	0
Others	2	100	0	0

* As identified during interviews.

E. Industry Priorities for Government Action

Throughout this research study, interviewees emphasized that government has an important role to play in support of the plastics industry. Some respondents offered their opinions of the role government is best suited to play (Table 13).

In most respects, the role that interviewees suggested government should play is very traditional. They most frequently suggested the following:

- Government should show increased support for vocational secondary education, especially disciplines that teach skills sought by plastics-related companies.

- With direction from industry, government should provide staff or other assistance to coordinate and enhance the array of education and training resources found in the North Central Massachusetts region.

- Government should pursue policies that are in the best economic interests of the plastics industry.

- The creation of a plastics technology center that includes a facility with administrative and training staff and that has molding, moldmaking, or other equipment on-site is not broadly embraced by industry.

Table 13

Suggested Roles for Government*

Role	Total
Support or enhance school	8
Help coordinate what	6
Supportive	6
Create a center	3
Promote industry	2

* As cited during company interviews.

Chapter 4
National Models of Industry Centers

In this section we report on our investigation of various technology and training assistance centers across the United States. This survey was done to learn about how successful centers—especially centers that worked with plastics firms similar to the ones in this region—structured themselves, what their sources of funding were, and how much they involved industry representatives in their operation. Our typology is drawn from an investigation of centers in Ohio, Pennsylvania, Minnesota, Wisconsin, New York, Indiana, as well as other regions of Massachusetts.

Typology of Assistance Centers

In looking at different centers, we were able to categorize them according to size and mission in the following ways: high-level research centers, state-funded institutions, and regional-local centers.

A. High-Level Research Centers

These centers are most often housed on a university campus and for the most part conduct research on such topics as new materials, polymer science, modeling of new products, and the links between biological sciences and plastics materials. They are typically funded through large grants to faculty members from federal agencies like the National Science Foundations. They also draw funding from large corporations that provide annual funding to the center in exchange for faculty research time and first access to any research discoveries. Such centers—which are located at UMass Amherst and UMass Lowell—have considerable overhead costs in laboratories, state-of-the-art testing equipment, and staff expenses.

An example of such a center is the Center for Advanced Material Processing (CAMP) at Clarkson University, Potsdam, New York. Corporate sponsors include Kodak, Xerox, Sylvania, and Corning. With a fiscal year 1998 operating budget of $3.2 million, CAMP received $1 million from the state for specific firm projects and almost $2 million from corporate sponsors. An additional $225,000 came from federal grants from the Department of Energy and the National Science Foundation. Research was conducted for firms on particle

synthesis, adhesion, film construction ,and the properties of advanced, biodegradable materials. The College of Engineering at the University of Wisconsin–Madison operates a Polymer Processing Research Group funded by industry sponsors and various state and federal agencies. The center has a polymer processing laboratory and a processing simulation laboratory to carry out its work.

B. State-Funded Institutions

These centers exist across the country. Some centers focus on a particular industry, but it is more likely the case that such centers broker a variety of services to several industries in a particular region of a state. The best examples of these centers are the Ben Franklin Partnerships in Pennsylvania, the Edison Institutes in Ohio, and the Manufacturing Partnerships in Massachusetts. For the most part these kinds of centers draw on the resources of existing technical and community colleges, universities, and independent education and training centers to provide services to firms. More often than not these centers provide basic services to firms on a fee-for-service basis and act as brokers when advanced technical assistance is required. Firms execute contracts with consultants for more advanced technical work.

Centers often organize workshops and seminars where technical papers are presented and managers interact to discuss common problems. Often, overhead costs are minimized through the co-location of center staff at an existing facility at a university or community college. Centers derive their budget from a combination of federal and state funds, often through a grant application process to the National Institute of Standards and Technology and an existing state-level manufacturing assistance program.

The Ben Franklin Technology Partners of Southeastern Pennsylvania is a nonprofit corporation working in a five-county region around Philadelphia, Pennsylvania. According to its mission statement, Ben Franklin "forms strategic partnerships with economic development organizations, research institutions and universities to provide financing and technology solutions for technology-based and growth-oriented companies." The center offers funding to firms for such things as prototype development, early-stage product commercialization, and manufacturing process improvements. Ben Franklin brokers a range of services to firms in collaboration with a network of state and federal economic development organizations and universities in such areas as product development, in-plant problem solving, total quality

management education, market development, and export assistance. Started in 1983, Ben Franklin has grown to be the largest source of seed capital in the Philadelphia region.

In Ohio, there are seven Edison Technology Centers. Each of the seven centers receives an annual operating budget from the state and in addition each center has a membership that contributes to operating expenses. According to an independent study of the economic impact of these centers, they leveraged 2.3 dollars in federal and industry funding for every dollar of state funding received between 1994 –and 1998. Started in the mid-1980s, over the course of their existence the Edison Centers have relied less on state dollars as a result: In 1994 state funding accounted for 45 percent of revenues; in 1998 this had dropped to 23 percent. The centers serve as a direct link between Ohio universities and state and federal government programs and act to strengthen firms through a variety of technical assistance efforts including applied university research, materials testing, mold analysis, economic studies, shop-floor assistance projects, and industry-specific seminars, forums, and conferences. Two of the seven centers—the Edison Polymer Innovation Corporation and the Edison Materials Technology Center—work almost exclusively with plastics firms and provide assistance in materials research and development.

There is also a Plastics Technology Deployment Center that operates a full-service referral center from the Erie campus of Pennsylvania State University. Staff members work with firms to resolve short-term production problems and also refer companies to an extensive network of experts for more detailed technical assistance. Two- and three-day seminars are offered on such topics as blow molding design, injection mold filling analysis, and 3D solid modeling. The center is partially funded through the National Institute of Standards and Technology's manufacturing program.

C. Regional–Local Centers

Centers often focus on a specific industry in a limited geographic area with an existing cluster of companies. The focus of these centers tends to be workforce development, with little, if any, technical assistance offered one-on-one to firms. Funding usually comes from Job Training Partnership Act (JTPA) accounts, state workforce development funds, dislocated worker retraining accounts, and Regional Employment Board training funds. Firms and/or workers often pay a small fee for worker training. Unlike the university-based centers, firms rarely pay in advance for training and thus limit the overhead expenses that centers like this

can have. Where there is an active industry trade association, for example, the National Tooling and Machining Association in Greater Springfield, Massachusetts, firms may pay an annual fee that does support the overhead needed to organize and offer workforce education and training courses.

The Erie, Pennsylvania, Skill Center is an example of a local center that offers post-secondary technical training. The center offers hands-on training in basic machining, machine tool programming, plastics technology, and tool and die making. It also operates a Web site with information on full-time and part-time training available in the region and it publishes an on-line newsletter with feature stories about local industry. Grants from the Erie County Service Delivery Area and Private Industry Council support training. The tool and die program prepares students for an apprenticeship in moldmaking with a curriculum that includes classroom and hands-on activities, while the plastics program prepares students to assume positions in quality control or machinery operation. In addition to the full-time program the Skill Center offers part-time evening upgrading courses that carry two-year technical college credit. Courses include mold setup, injection mold processing, troubleshooting in the molding process, injection mold maintenance and repair, and mold design. Skill Center instructors also conduct on-site classes in local companies.

The Delaware Valley Industrial Resource Center (IRC) was established in 1988 as part of a three-year, $30 million appropriation from the Pennsylvania Department of Commerce to boost the state's small and medium-size manufacturers. The Department of Commerce required that the centers set up under the program be directed by the local business community, that they respond directly to the needs of regional industries, and that they demonstrate demand for their services by matching public funds with private sector dollars. The Delaware Valley center has an executive director, two administrative assistants, and several field agents with expertise in industrial engineering, organizational development, accounting, and general business management. Its stated mission is to "improve the competitiveness of small and medium-size manufacturers in the region. We will team with our customers to raise awareness of the benefits, provide training for the adoption, and facilitate the implementation of world class manufacturing philosophies and techniques." The center works one-on-one with firms and also offers seminars and workshops on topics of general interest to industry through a CEO Forum that meets six times a year and a Statistical Process Control Coordinators' Network. IRC staff coordinate these group activities.

General Attributes of Successful Centers

Despite quite discernible differences in structure, size, and funding sources, we found that organizations shared important characteristics. Case studies of centers were reviewed, on-line descriptions of centers consulted, and interviews conducted to learn how centers functioned. *Productivity enhancement.* The organizations assisted firms in productivity-related areas, such as technology acquisition, financial management, product development, marketing, quality enhancement, and workforce education and training.

A. Focus on Small and Medium-Size Firms

The services of most centers are targeted to small and medium-size enterprises, since these firms are perceived to face greater resource constraints in successful reorganization. Centers sought to reduce the risks and costs associated with adopting organizational and technical innovations and distribute the expenses associated with training and education across a large number of enterprises.

B. Group activities

Many centers focused on helping firms, one-on-one, to upgrade their technology, but they also realized that individualized assistance limited the number of firms that they could reach. Therefore, group activities were also stressed. The overwhelming majority of organizations that survive the start-up period combine single-firm activities with group activities, such as workshops and seminars.

Supporting Plastics Companies Through a "Center"

From our review of various industry centers, five characteristics emerge as critical for the design and effectiveness of a plastics technology center in North Central Massachusetts: It must be *credible, connected, catalytic, collective, and continuous.* These characteristics are common among centers of various sizes and missions.

First, the organization must be *credible* with industry representatives. From our interviews with firm owners, it appears that one of the most important functions of an organization is the provision of information on new technologies and manufacturing processes. Every employer noted the overwhelming quantity of material they receive about various improvement programs.

Since employers are reluctant to utilize the services of an organization they do not know or respect, the establishment of credibility is extremely important. Since credibility is somewhat contingent on the length of relationships, we contend that an organization which develops out of existing relationships with firms is the most likely to succeed expeditiously. Rather than creating new institutions, existing institutions with successful records of work with firms—such as a trade associations or technical school—were utilized whenever possible.

Second, the organization must be *connected* at the outset. By this, we mean the organization should be linked to the range of training institutions, business and trade associations, financial institutions, and technical colleges and universities to network services and benefit from the institutional learning that has already taken place. Organizations provided highly valued assistance to firm owners by screening potential consultants and facilitating relationships with local and state training organizations. In this respect they performed a quality control function that reduced the likelihood of costly mistakes in the selection of consultants and training vendors.

Third, the organization must be *catalytic;* it has to make things happen. It must channel the energy built up through meetings, one-on-one firm visits, and other activities beyond the usual telling of "war stories," and then go to problem solving and knowledge diffusion. As interviews with local firm owners confirmed, the learning exchanges that worked best were those between industry peers. This exchange does not happen spontaneously, either in the lives of firms or in the course of an organization's own daily routine: *Bringing firms together requires purposeful behavior.*

Fourth, the organizations we reviewed pursued a variety of *collective* strategies along with their one-on-one efforts. One-on-one consulting and technical assistance services are important to establish credibility, facilitate firm-level change, and in many cases move beyond discussions to implementation. To reach a scale of activity commensurate with the number of firms in this region, group work is imperative. Strategies need to be articulated and carried out to promote interfirm learning and create opportunities for firms to act on issues of common concern. For example, the Delaware Valley Industrial Resource Center has a Statistical Process Control Group and a Continuous Improvement Task Force. It also conducts regular plant tours that have been highly regarded. The exposure to other firms' change efforts was an important element of the

regional education process, because the encouragement and validation that owners, managers, and workers experience through group activities provides them with confidence to pursue firm-level change.

Fifth, whatever organization is established must clearly have staying power—it needs to be *continuous.* Therefore, stable funding is essential, as is staffing and leadership. Most organizations, particularly those supported primarily with state funds, often receive one-year grants but are expected to demonstrate private-sector demand for their services quickly—or risk losing their support. Our research suggests that an alternative funding strategy is required. Less money should be granted at start-up, with the understanding that funding will grow over time as credibility is established and synergies are created between firms, workers, and service providers. Three years of predictable funding are important to allow the organization to find its way. These efforts at industrial vitalization are not an exact science, and funding sources need to recognize this. If the organization is progressing, more support is needed in the second year of operation than the first year; after this, mechanisms can be put in place to reduce public support and increase industry support.

Chapter 5
Conclusions

This consulting project was motivated by one principal question, asked by the City of Leominster to the plastics industry: Would a plastics technology center strategically bolster the strength and vitality of the plastics industry? The simple answer to the question is no, the industry does not need a stand-alone plastics technology center at this time. That blunt answer conceals the much more important and difficult work that needs to be accomplished. The overall challenge is this: Will the industry provide the leadership, direction, coordination, and structure needed to mobilize resources? The City and the North Central Massachusetts Chamber of Commerce's Plastics Council have the opportunity to reestablish a common, industry-led agenda that promotes the continuous renewal and vitality of this very significant component of the Massachusetts economy. The ability of the City, the Chamber, and the Council to organize their resources through the Council will test and predict how well other resource stakeholders will be able to support the plastics industry in North Central Massachusetts.

The most critical step that can be taken to support the regional plastics industry is for the senior leadership of the City of Leominster, the Chamber of Commerce, and the Plastics Council to cast aside past misunderstandings and rivalries and work together in a constructive manner. "Industry-led" means that the Council will need to build a structure that coordinates the many, many organizations that have the ability to support the plastics industry. The Chamber and the City can be the first organizations to utilize the structure provided by the Council. In effect the Council will offer the means by which stakeholders can seek contact, support, and leadership from the plastics industry. Following are some simple, but essential symbolic steps that could be taken.

The Council could hold a press briefing to express the its perspective on this report. The Mayor of Leominster, the Executive Director of the Chamber, and other key individuals would be invited to participate. At such an event, the Council could exemplify this new era of cooperation by explaining how they intend to invite the regular engagement of the City and other key institutions. The City would acknowledge that steps toward providing companies with technical assistance and other resources need to be directed by industry. A public summit of the Mayor of Leominster, President of the Chamber, and Chairman of the Plastics Council would be a symbolic initiation of

this new relationship. The essence of this recommendation is that the Council offer a structure that ensures appropriate avenues for participation.

A further refinement is to announce that the Council will, through memorandums of understanding (MOU), implement new relationships with key institutions. We recommend that staff be directed to develop a formal MOU between the City and the Plastics Council by a definite due date for signatures. Even the process of negotiating, drafting, and redrafting the MOU will force staff of the Chamber and the City work together more closely than in the recent past. The MOU should be a "living" document that changes to meet the evolving needs of its signatories.

The City and the Chamber each have staff who work on plastics industry–related issues. Initial steps suggested to build this partnership are for the City and Plastics Council to coordinate the work activities of these staff. A second step might be to co-house the staff so that they will physically work together on a daily basis. A third step is to invite other organizations to join the MOU. As this relationship matures, the City and the Chamber (as well as other organizations) may consider strategies to actually merge resources—though it is understood that the requirements of specific funding agencies may impede this idea.

Most importantly, the signatories should agree on committing to one feasible and major objective. We are aware that NYPRO Industries may be willing to cosponsor an executive seminar series that focuses on strategic marketplace issues. We believe an effective seminar series would benefit industry executives directly and provide an excellent venue for placing the North Central Massachusetts plastics industry into a global economic context. The Council could ask the City to support the coordination of such an effort. This would be a good opportunity to merge resources.

Focus Now on Improving Effectiveness of Existing Resources

Companies repeatedly cited training and workforce development as critical needs during our interview process. Though training and workforce development needs varied according to different types of plastics-related companies, common subthemes included training and education of both incumbent workers and the available workforce. Companies also emphasized the need for enhanced secondary school programming to prepare young people to work in the industry.

For regional, sustainable growth in the plastics industry to occur, there must be a consistent focus on knowledge creation, enterprise development, and industrial innovation. By industrial

innovation we refer not only to the number of scientists working in research laboratories like those at UMass Amherst, but also to product development, factory floor process improvements, market and technological diversification, industrial specialization, and the nurturing of new industrial subsectors.

The North Central Massachusetts area is endowed with a myriad of educational, training, and technical resources available to the plastics industry. The immediate challenge facing any effort to help the plastics industry today is to coordinate and enhance these resources and help companies sort through and make sense of available assistance. This effort will encourage the utilization of existing training and education resources. It will also improve efficiency and ensure that local programs are complementary rather than competitive.

A strategic focus on a wide variety of training and educational programs helps resolve the problem of scale, promotes peer learning, and helps build and maintain a social and technical infrastructure capable of surviving the almost certain withering of public financial support. Among the industry centers we interviewed, a critical value-added was the venue the programs provided for firms to discuss and assess problems together and to learn from each other. Left on their own, firm owners do not discuss common market failures such as the lack of skilled moldmakers and product design engineers, the demise of key customers in the region as large corporations outsource and shift work abroad, and customer demands to step up quality control and reduce prices. The challenges facing area plastics firms are greater than any single firm can resolve, and the high degree of interaction that takes place in terms of such areas as sales and subcontracting makes it imperative that regionwide efforts to boost the industry be strengthened.

There is no question that the successfully operating industry centers we reviewed play an important role in propelling manufacturing firms toward better performance. The learning dynamics established by the intersection of firm-specific activity (important for the development of precise knowledge of a firm's problems) with cross-firm activity (important to promote regional and sectoral development) provides the justification for public expenditures on these programs. By helping firms develop a vision and a strategy for change *as well as* providing access to the resources required to implement change, manufacturing modernization organizations reduce the uncertainty and risks that most firms associate with change.

Our research indicates that if a center is to be developed, it should coordinate and enhance existing services. Development of a center should be incremental. The cost and demand for new services should be fully understood before resources are committed. To maintain industry support, the center and its activities must be substantially directed by members of industry. Leadership of a technology center should be collaborative, engaging the energies of government, industry, and the Chamber of Commerce and its Plastics Council. Collaboration is viable if pursued with vigor. The immediate challenge is not to plan a facility. The immediate challenge is for patient, deliberate leadership.

In our view, leadership is the first, critical requirement for developing an effective partnership between the City and the Chamber's Plastics Council. This leadership is needed to direct staff and institute a top-down mandate for, and in the spirit of, cooperation. As mentioned above, the City needs to support the idea of an industry led collaboration. The Plastics Council, in turn, will be responsible for engaging and maintaining the involvement of City and other key institutions in strategic decision making.

Forging collaboration between the City and the Chamber's Plastics Council is essential regardless of future development of a center. Such collaboration will provide a structure for a continuous and organized decision-making forum and will provide companies, the City, and other key institutional leaders to identify needs and to formulate, implement, and manage plans to strengthen the plastics industry in North Central Massachusetts.

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