

# Technology Innovation & Rural Development

*Lessons from Italy and Denmark*



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Southern Technology Council  
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## About the Rural Economic Policy Program of The Aspen Institute

The Rural Economic Policy Program (REPP) was created in 1985 as a collaborative program of The Aspen Institute, The Ford Foundation, and the Wye Institute. Working closely with The Ford Foundation's Rural Poverty and Resources Program, the REPP encourages greater attention to rural policy issues through a program of research grants, seminars, and public education. The Rural Economic Policy Program is housed at The Aspen Institute in Washington, D.C. The Aspen Institute is an international nonprofit organization whose broad purpose is to seek consideration of human values in areas of leadership development and public policy formulation. The Program is focused on rural concerns, including agricultural policy, community economic development, resource management and enhanced livelihoods for the rural poor. REPP is funded by a grant from The Ford Foundation.

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## About the International Rural Exchange Fellowship Program

In 1989-90, the Rural Economic Policy Program of the Aspen Institute (U.S.) and the Arkleton Trust (U.K.) co-sponsored an International Rural Exchange Fellowship Program to encourage comparative assessments of innovative approaches to the economic, social, political, and environmental problems and opportunities faced by rural communities in Europe, Canada, and the United States; foster comparative analyses to inform and improve rural policy and program development; stimulate and revitalize rural development practitioners by exposing them to fresh approaches to shared problems; and assure wide dissemination of fellowship results. This report on innovative applications of technology and innovation to economic development is a product of the fellowship awarded to Dr. Stuart A. Rosenfeld, Director of the Southern Technology Council of the Southern Growth Policies Board, an interstate compact in the South dedicated to promoting economic development and fostering regional cooperation.

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# Executive Summary

Over the past five years in many parts of western Europe the public and private sectors, working together, have devised and implemented a comprehensive set of programs and policies that rely on science and technology to achieve rural economic development. European nations acknowledge the importance of science and technology to industrial competitiveness and invest accordingly. But, in Europe, as in the United States, technology-based approaches to economic development have tended to favor more urban areas, which have more sophisticated infrastructures and greater numbers of scientists and engineers in the labor force.

This report examines development policies in less urbanized but industrialized and industrializing regions of two European countries to find out more about the successes and failures of science and technology in promoting rural development, the ways in which local and state governments and European Community programs have contributed, and the conditions that have impeded or spurred development. Two regions were studied: north-central Italy, popularly known as *Terza Italia* or Third Italy, and northern Jutland, on the mainland of Denmark. All were until recently quite poor by European standards, but, relying heavily on technological innovation, the strength of their small firm and artisan sector, and local leadership, they have been transformed into healthy and growing industrial economies.

The common features of economic development in Italy and Denmark include first, and perhaps most importantly, a strong reliance on cooperative ventures and integrated phases of production among small and medium-sized enterprises (SMEs), sometimes referred to as "artisan firms." Second, both regions look to what they call Centers for Real Services ("Centers") to support critical needs that the market cannot support. Third, the European Community and the potential of the single European market influences programs and policies set locally. Fourth, both regions consider a strong information system linked to the rest of Europe and to its markets essential to success. Fifth, design is considered a very important factor in competitiveness and is evident in all aspects of production, from the work environment to the product. And last, each considers the world, not the region or state, as its market area. The remainder of the paper provides general background about European Community conditions, tells the stories of the two regions, and draws out lessons for U.S. rural economic development policy. To gather information about these lesser

populated areas, more than 50 people representing industry, education, local, regional, and state government, research organizations, and service providers were interviewed.

Both industry and government in Denmark and Italy understand that the competitive advantage of regions is achieved through the competitive advantage of their industries. Development policies are designed and implemented to help make firms, most of which are locally owned, more competitive in global markets. The sources of competitive advantage are product and process innovation, quality, and differentiation. Factors that support innovations, quality, and differentiation are:

- (1) business and personal relationships;
- (2) ease of information flow;
- (3) access to services and consultancies;
- (4) fusing of market development, design, and technology; and
- (5) public policies.

**Business and Personal Relationships:** Strong relationships among firms are used to advantage by small cities in both Italy and Denmark. These relationships provide opportunities for innovation by expanding available technological know-how. As observed in the ceramics district, firms that produce manufacturing equipment are considered extensions of the technical staffs of the ceramics firms. Relationships with customers provide access to the outside world and information about potential markets. Such relationships provide opportunities for greater cost-effectiveness through shared services; are responsible for the rapid spread of innovations among firms, which creates a need to constantly innovate and stay ahead of local competitors; and represent a collective economic power that turn small firms into major players in world markets.

**Ease of Information Flow:** In a modern economy, access to information is vital. Small cities in Denmark and Italy have taken steps to make sure that information flows freely and effectively. The tight, personal relationships described are one way that information can flow more effectively. But it is also important to have access to the outside world. For this, telecommunications systems are considered vital. Information is

considered so important to growth that the European Commission's Science & Technology Directorate allocates 40 percent of its budget to information technologies.

**Services and Consultancies:** To ensure that information is used effectively and that innovation is fully supported, technical advice is made available to SMEs at low cost. Service centers in Italy and technical institutions in Denmark provide an array of services to help firms improve their product and process quality, develop new products and processes, and lower costs. At the point firms are ready for technical advice, they generally are ready to pay costs incurred. Subsidies provided to encourage innovation and research are expected to be repaid if the venture is commercially successful.

**Marketing, Design, and Technology Deployment:** In Italy and Denmark, market information and design are considered a vital part of technology deployment, and single agencies are concerned about both. It is the market that drives the need to innovate and modernize. In too many states in the U.S., separate agencies deal with marketing and technology, while no agency addresses design. And even marketing and technology are not often mingled.

**Public Policies:** Although local development occurs in Italy and Denmark through the competitive advantage of firms, the public sector takes an active role. Industrial policy is not avoided but considered a legitimate role for government. Programs are aimed at altering behaviors in the economic sector and sharing risks. Governments assist firms in taking their first steps, but once the firms learn to walk, they are on their own. Some U.S. programs are also designed to encourage risk-taking, such as incubators, seed capital funds, and small business innovation research programs. However, more U.S. dollars are spent on activities that most likely would have been undertaken by the companies even in the absence of subsidies, such as customized training, or to influence locational decisions, such as industrial revenue bonds, not to enhance firms' competitive advantages.

**Education and Skills:** Skills and knowledge are of course important to the competitive advantage of industry but seem to be less of a factor than in the United States because there is less need. Educational levels are on average higher in Denmark and Italy, and the pool of chronically unemployed is much smaller than in the United States. The organization of work in many of the large companies visited was not particularly progressive, however, and management did not look to its operators for innovations. If anything

automation has led to a bifurcated labor force with fewer skill needs among operators and greater skill needs among technicians. The situation was reversed in the engineering firms, where skill needs have become much higher, but the technical institutes and apprenticeship programs are able to turn out a sufficient number of technically trained workers.

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## Toward a Modern Rural Industrial Policy

Even though Italian and Danish experiences with rural technology-based development are tied to the two nations' own cultural traditions, economic profiles, and political systems, each possesses certain elements that can be useful in many industrialized and industrializing less populated regions.

The first and perhaps most basic revision of rural development policy is to shift the emphasis from localities competing with neighboring communities and states to introducing programs that are aimed at making local firms more competitive. Competitive firms produce competitive localities and nations. This simple shift in emphasis in economic development represents the very underpinning of the European successes. This approach broadens the focus of policy from recruitment to innovation and building "inner strength." The key lies in the acceptance of the relationship between modernization and economic growth.

Second, government programs should be catalysts and stimuli, not props or crutches. Government funds should be used to encourage the most innovative and promising private decisions. One approach is that used in Denmark, where local communities were given opportunities to apply for grants for programs likely to lead to technological progress. Implicit in this strategy is the need to acknowledge some failure as well as relishing the successes. In both nations, the incentives were phases of planned modernization programs.

Third, governments supply information needed to make informed decisions. The public sector at all levels of government has been acknowledged and accepted as a resource for agricultural enterprises in the United States since the end of the nineteenth century. Industry, which has many of the same needs for information, has never had the same public support, and government has never earned the same level of trust from industry. This need for information today extends all the way from the laboratories doing research to the firms making decisions about what to use and how to use it.

Fourth, governments can be catalysts for innovations that involve more than one firm. They can stimulate new and innovative behaviors among firms, such as the alliances and collaboration that the Italian government promoted in the late 1970s through the early 1980s, and which the Danish government has promoting since 1989.

Fifth, programs and policies should be comprehensive. The most important aspect of European programs and rarely found in the United States is the linking of programs addressing marketing, design, and technology. In most states technology and marketing are supported by different agencies and design is rarely considered at all. The programs and centers that provide services to firms in Denmark, and particularly in Italy, consider all three elements to be essential components of competitiveness. Italian colleges of engineering are noted for including aesthetics and design in their curricula. Design schools in the U.S., many of which are world-renown, are usually separate from engineering and business.

Sixth, as emphasized strongly by Michael Porter in *The Competitive Advantage of Nations*, rural or regional development efforts must identify strengths and build

on clusters, not import random or diverse plants or services. The clusters require magnets such as colleges or centers for services or special infrastructure. But only through such clusters will developing and self-sustaining growth take place.

Last, but still most importantly, governments are responsible for human resource development. Public education from kindergarten to grade 12 is a local responsibility under state authority. How that education meets the needs of the local economy, however, is mainly up to local officials. Once again, agriculture provides a historical model, with education playing a key role in modernization. From the days of the Grange and Farmers Alliance, when the phrase "Knowledge is Power" shaped both policy and practice, to today, when FFA alumni organizations' adult classes inform farmers about new methods, education has been crucial to innovation and competitiveness.

These recommendation will no doubt be molded and adjusted to the specific conditions in small cities in the United States and to the needs of their firms. But the importance of innovation and technology transcends cultural differences and political boundaries.

## Introduction

Over the past decade in many parts of western Europe, the public and private sector, working together, have devised and implemented a comprehensive set of programs and policies that rely on science and technology to achieve economic development. European nations both formally acknowledge the importance of science and technology to industrial competitiveness and invest heavily in it. As in the United States, however, nations and regions have taken somewhat of a shotgun approach, i.e., trying out a myriad of initiatives to see which—under their own particular circumstances—will come nearest the bull's eye. And as in the United States, technology-based approaches to economic development have tended to favor urban areas, which have more sophisticated infrastructures and greater numbers of scientists and engineers in the labor force.

This paper will examine some of the development policies in less urbanized but industrialized and industrializing regions of two European countries to learn more about successful instances of rural development based on science and technology, ways local and state government and European Community programs have contributed to that process, and conditions that have impeded or amplified development. The two nations studied were Italy and Denmark. Within the two nations, the regions studied were Emilia-Romagna and Lombardia in central Italy, which lies within the informal boundaries of what is popularly known as *Terza Italia* or Third Italy, and northern Jutland, the mainland of Denmark. All were until recently quite poor by European standards but, relying heavily on technological innovation, the strength of their small firm and artisan sector, and local leadership, have transformed themselves into healthy and growing industrial economies.

Different natural endowments of the regions have led to dissimilar approaches to rural development but with important features in common. Italy has a large number of "industrial locomotives"—large final producers—and is considered a major industrial power in Europe and in the world. Denmark, in contrast, has few industrial locomotives but possesses a strong education system and considerable experience in world trade and is the only nation to be a member of both the European Community (EC) and the Nordic Council. It endeavors to capitalize on knowledge-based industries and to become the "nerve center" of Europe.

The two countries' historical and political circumstances have led them down different development paths. In central Italy, the long-term formation of "industrial districts" (a geographic conglomeration of firms in various phases of making a specific type of product, including as well various services related to producing and marketing that product) and the presence of strong trade and labor associations provided opportunities that were not available among the more dispersed and not so well organized businesses in Jutland. These differences have led to distinctions, according to Belgian economist Michel Quevit, between "a *spontaneous* approach of local development," which more closely characterizes Italy and "a *voluntarist* approach" with greater public sector intervention, which more closely characterizes Denmark. Economic opportunities seem to drive policies in Italy, while policies are more often established to stimulate economic opportunities in Denmark.

Common features of economic development in Italy and Denmark include first and perhaps most importantly a strong reliance on cooperative ventures and integrated phases of production among small and medium-sized enterprises (SMEs), sometimes referred to as "artisan firms." Second, both regions look to what they term Centers for Real Services ("Centers") to meet special business needs that the market cannot support. Third, the European Community and potential single European market influence programs and policy set locally. Fourth, both regions consider a strong information system linked to the rest of Europe and to its markets essential to success. Fifth, design is considered a very important factor in competitiveness and is evident in all aspects of production, from the work environment to the product. And last, each considers the world, not the region or state, its market area.

The remainder of the paper will provide some general background about European Community conditions, tell the stories of the two countries, and then draw out the lessons for U.S. rural economic development policy. To gather information about lesser populated areas, more than 50 people from industry, education, local, regional, and state government, research organizations, and service providers were interviewed (see Appendix A). Experts thoroughly familiar with the economies of each of the regions—Dr. Mario Pezzini, economist with Nomisma in Bologna in Castel Goffredo; Dr. Margherita Russo, economist at the University of Modena in the ceramics district; and Dr. Lars Gelsing, economist with the Institute of Produc-



tion at the University of Aalborg in North Jutland—helped organize the trip, analyze findings, and interpret where necessary.

### Rural Policy and Technology Diffusion As Viewed by the Commission of the European Community

Most of Europe can hardly be termed rural by conventional American standards and definitions. Yet a large proportion of its population lives in small cities, villages, and rural areas. An important distinction is that in Europe distances between communities are less and average population densities higher compared to the rural United States. Italy, for example, has about the same land mass as the states of Florida and Georgia combined, but three times their combined populations. Despite the relatively short distances, people in many parts of Europe travel and commute to jobs in neighboring communities less than do workers in the U.S. Thus, towns and villages located near one another or near to large cities often maintain their own distinct identities as communities and economic entities without being swallowed up by larger neighbors or being transformed into suburbs. North central Italy and northern Denmark are no exceptions. In Emilia-Romagna, much of the growth in jobs has occurred along the major East-West highway and in the small and independent towns that lie short distances from the major cities. In Denmark, most of the growth has occurred in and around its few large cities, but national policies have helped to disperse industrial jobs to smaller cities as well. Citizens of these industrialized towns and small cities, such as Fiorano and Sassuolo in Italy and Saebý, Grená, and Hadsund in Denmark, view their municipalities as self-contained communities and tend not to think of themselves as suburbanites.

As long as European urbanization was considered a continuum from villages to large cities, classifications of European populations were superfluous. In the 1980s, however, pressures mounted to recognize the special needs of less populated areas, and the EC began to differentiate between urban and rural areas. The estimated urban-rural split in Europe is frequently cited as fifty-fifty; in the less densely populated United States, according to U.S. Census definitions only one-quarter of the population is designated as "rural." Thus, European and American measures of rurality are not strictly comparable. A recent report prepared as part of a proposal for a new EC program called *Opportunities for Applications of Information and Communications Technologies in Rural Areas* (ORA) uses a more detailed rurality index, classifying each region in the

EC in one of six categories from *Very Urban* to *Very Rural*. Based on this scheme, 177 of 562 EC regions are *Very Rural*, 170 are *Intermediate Rural*, and only 27 are *Very Urban*. Using regional indices, however, is the equivalent of judging rurality in the U.S. by state averages, and a wide range of varying circumstances may be overlooked. For example, all of Emilia-Romagna is classified as *Intermediate Rural* even though individual provinces and communes within the region run the full gamut from *Very Rural* to *Very Urban*.

Before the mid-1980s, The Commission of the European Community saw no need to recognize rural areas with respect to any sorts of special policies or attention. Many of the smaller cities and towns in Europe were supported either by agriculture, tourism, or artisan/small-scale manufacturing firms. Heavy manufacturing and international trade was concentrated in and around the large population centers. The EC did, however, acknowledge differences in relative wealth, and in 1975 it established a Regional Development Fund to address disparities between have and have-not regions. Special funds were earmarked for less-favored regions, for declining regions, and for agricultural regions in transition. By the mid-1980s, however, the EC began to turn from economic development based on trade, capital, and traditional infrastructure to development derived from investments in science and technology. In 1985, the European Commission elevated the stature of science and technology and made them integral parts of its plans for unity and a competitive industrial base. The EC formally established mechanisms to accomplish this objective in the Framework Programme for science and technology in 1987.

Though there was concern about "less favored" regions, no attention was paid to urban-rural differences within regions initially. Yet it was clear that technological resources were even more heavily concentrated in large cities than were the traditional resources. Biases and disparities in capabilities and needs were officially recognized for the first time in this report. Gaps between the centers of largest cities and rural areas in technology capacity measures—such as business expenditures on R&D or number of scientists and engineers in the work force—are three to four times greater than gaps in economic performance measures. In Greece, for example, 82 percent of all R&D occurs in Athens, and in Spain, 76 percent takes place in Madrid and Barcelona. In the United Kingdom, 65 percent takes place in the Southeast, which represents the greater London area.

In 1988, ignited by the new science and technology initiatives and further jolted by increasing loss in

farming employment, desires for greater rural community cohesion in the face of the single Europe, and a wave of new environmental interests, the EC prepared a statement on rural issues. *The Future of Rural Society*, released in July 1988, endorsed efforts to stimulate and diversify the supply of services to firms; accept and encourage grouped activities (networking) and develop subpoles of economic activity in smaller cities; and to promote the use of public subsidies as catalysts for development. The statement's recommendations were for (1) a common agricultural policy; (2) expanding forestry-based industry; (3) protecting the environment; (4) promoting more rationale use of energy and development of renewable sources; (5) regional policies based on developing indigenous potential; (6) supporting small businesses, especially through the dissemination of new technologies; (7) more research and development; (8) new information and telecommunications technologies connecting the countryside and main centers of activity; (9) better education and training; and (10) fostering the flow of information and awareness. The sites identified for investigation were chosen to illuminate these issues, particularly as affected by science and technology.

It is interesting to note that while people talked freely about the role of technology in their future, no one interviewed echoed the EC's concern about the need for rural policies. There were very definite regional concerns expressed, but they were not perceived as specifically rural. A major reason seemed to be that people in small industrialized towns tend to identify with urban areas, and distinctions are made among levels of urbanization, not between urban and rural areas. Rurality is associated with agriculture or with lesser-developed areas, according to those interviewed. Further, the large cities in Europe have not had the urban problems of large U.S. cities, and there is not the same perception that large cities have received more than their fair share of public benefits and government services. If anything, government policies have tended towards balanced growth by moving jobs out of the cities. Thus, urban-rural factionalism has not developed as it has in the United States. In Italy and Denmark, factionalism is more often along ideological and political lines.

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### **Science, Technology, Innovation, and Economic Development**

The European Community's Framework Programme for science and technology and its report on rural society (1984) reflected and reinforced changes in national development policies that already were taking shape. The three aspects of economic development

identified by the EC in the report on rural society—stimulating diversified services, focusing on subpoles of activity, and grouping services—represent staples in the basket of development practices in the regions visited. Each is tightly linked to technology and innovation. For example, the supply of needed but missing technological services through public, quasi-public, or private centers has been a major element of local development programs in both Italy and Denmark for a decade. The goals of encouraging grouped activities and strengthening subpoles of activity also are not new for either country. In central Italy small, flexible and specialized manufacturing firms form networks that respond quickly to market conditions and provide firms with economies of scale and strength of numbers to proliferate, innovate, and prosper. Aggregation of similar and related businesses often occurs in specific locations, and when a critical mass is reached, they become known as industrial districts. In Denmark, traditional cooperatives and fledgling flexible networks help fortify and modernize SMEs.

In both nations, the state has intervened to speed technology-based development, providing both subsidies and technical support services. Subsidies, however, are generally part of long-term plans and are intended to stimulate activity, not to permanently underwrite it. Most programs are of limited duration and demand both matching funds and plans for long-term economic activity without subsidies. The technical assistance programs, which include research and development, quality testing and certification, and training, are longer-term and in most instances ask client firms to pay for services rendered. Only information is provided for free.

As Michael Porter points out in *The Competitive Advantage of Nations*, there are two ways to gain advantage: lower cost and product differentiation. Both Italy and Denmark, firms and areas visited seemed ready and willing to cede advantage based on costs to lesser developed countries and look to differentiation for their comparative advantage. States and rural communities in the U.S. have not yet come to that realization, leading to an important distinction between local technology-based development programs in America and those in Denmark and northern Italy. European communities' programs market the products and potential of their firms and provide subsidies to spur continued innovation to maintain market position. American communities market real estate and infrastructure to firms to provide subsidies to lower the local costs of doing business. Denmark and Italy help firms compete for new markets; American states help communities compete for new firms.

Paradoxically, innovation is driven by both cooperation and competition. The innovations that give firms and communities competitive advantage come from a wide range of conditions that emerge from the way people and firms relate to one another, to markets, and to opportunities. Innovation and technological change occur as a result of relationships between firms and suppliers; firms and customers; firms and competitors; firms and machinery producers; firms and employees. The formal process of technology transfer that begins with research by an agency or university and then moves through some intermediary agency to a firm is much less frequently a source of innovation. Although the R&D laboratories may be called on and certainly play a role, the impetus nearly always arises out of the firm responding to market opportunities or to competition.

Effective economic development in small cities and towns in the two countries studied appeared to be the result of the following factors, which in turn can be attributed to an environment that has developed and is nurtured. The elements of that environment are (1) ease of information flow; (2) access to services; (3) current and historical social and educational conditions; (4) business and personal relationships; and (5) public policies. Although the environment is influenced by national policies, regional and local circumstances dictate how they translate into productivity and shape the local economy. The factors that appear to lead to competitive advantage for specific industries in specific areas are:

- continual modernization and innovation with respect to production processes, product performance, and design;
- aggressive exposure, promotion, and international marketing of products;
- constant attempts to acquire or develop added phases of production to achieve as much self-reliance as possible;
- establishment of centers of services for those needs that market forces will not provide;
- fostering of networks and collective services to provide economies of scale and strength of numbers;
- intense competition among firms and groups of firms;
- high levels of local ownership;
- very active entrepreneurship; and
- use of state government and European Community programs to stimulate activity.

The effects of each factor will be discussed more fully in the concluding section of this report.

## Third Italy: Myth or Muscle?

So much has been written about the region in central Italy called *Terza Italia*, or Third Italy, that it is increasingly difficult to separate fact from fiction. That area, which encompasses the region of Emilia-Romagna, Umbria, Trentino, Veneto, Lazio, Tuscany, and parts of Lombardia, is currently portrayed as the industrial sector of the future, composed of flexible, specialized manufacturers using the most modern and sophisticated equipment and methods to adapt quickly and efficiently to changing demands and markets. Most experts attribute two structural characteristics to the success of the region: (1) collaboration among and networking of small and medium-sized and locally owned firms that makes possible economies of scale not attainable individually, and (2) industrial districts—sectoral clustering of firms covering all phases of production to collectively dominate markets and through competition spur innovation.

Two conditions are offered in explanation of the formation of this industrial model: an entrepreneurial spirit (and high rate of savings) of sharecroppers who farmed the land before industrialization and the quality of the technical schools that trained the labor force. Moreover, in the 1960s and 1970s a number of government policies and a surplus labor force also encouraged investments. But the economy of Third Italy is not so easily explained or similar successes would have pervaded the entire region. They have not. Many parts of Third Italy, even within Emilia-Romagna, do not support thriving networks of flexible manufacturers. Areas such as Ravenna and the rural mountain region of Parma, for example, have not developed significant industrial strength. Thus, there must be other local conditions that explain the development and modernization of the industrial sector in a particular location. Answers to the following questions might further explain the industrial vitality of Third Italy.

- What are the respective influences of both public policies and market forces?
- Is the flexibility of the industrial structure and level of entrepreneurial activity replicable anywhere else—and, in fact, is it still growing with the same intensity in Third Italy?
- How important and how pervasive are the networks and centers for real services? and
- Is such development possible in very rural areas and if so how must it be modified?

Two regions, Emilia-Romagna and Lombardia, are examined to shed light on these questions: within Emilia-Romagna, a ceramic tile district south of Modena, and the rural mountainous area in the province of Parma and within Lombardia, the women's hosiery district centered in Castel Goffredo and its neighboring towns.

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### Emilia-Romagna: Prototype for Industrial Success

Emilia-Romagna is archetypical Third Italy. By embracing flexible specialization, it has pulled itself up from last among all twenty Italian regions in per capita income in 1970 to second today. Nearly one in five of its 1.8 million workers is employed by its more than 40,000 manufacturers. Less than two percent of these firms employ more than 50 people. Bologna, the capital of Emilia Romagna, has been long known as the red capital of Italy. Its particular brand of communism, however, is more aptly described as a political party affiliation and social statement than an economic philosophy; the business sector is extremely competitive and entrepreneurial.

Emilia-Romagna is an old and historic but highly industrialized region. The city of Bologna lies approximately halfway between Milan and Florence and, despite its rich history, fine food, and the oldest university and medical school in Europe, is usually overlooked by international tourists. The region is considered "moderately rural" by European standards. Its population density is lower than Italy's average and includes densely populated urban-industrial areas around Bologna, Modena, and Reggio-Emilia as well as very rural mountain areas. About 57 percent of Emilia Romagna's surface area is cultivated, but only about 12 percent of the work force is engaged in agriculture.

Italy's regions date back only to 1970, when the Italian government divided the nation's land mass into 20 government entities and turned over to them responsibility for social services, land use, and economic development. Emilia-Romagna is further divided into eight provinces (equivalent to counties), which contain communes (equivalent to municipalities). In addition, informal groupings of contiguous municipalities with similar economies are called *comprensoria*. The *comprensoria* were proposed by the state in the early 1970s for collaborative planning among local governments, but because they had little authority and no clearly

defined responsibilities, they were not entirely successful. As a result they only remain in place in a few regions, mostly in Third Italy. Municipalities and provinces have their own government agencies, although only the state is authorized to levy taxes.

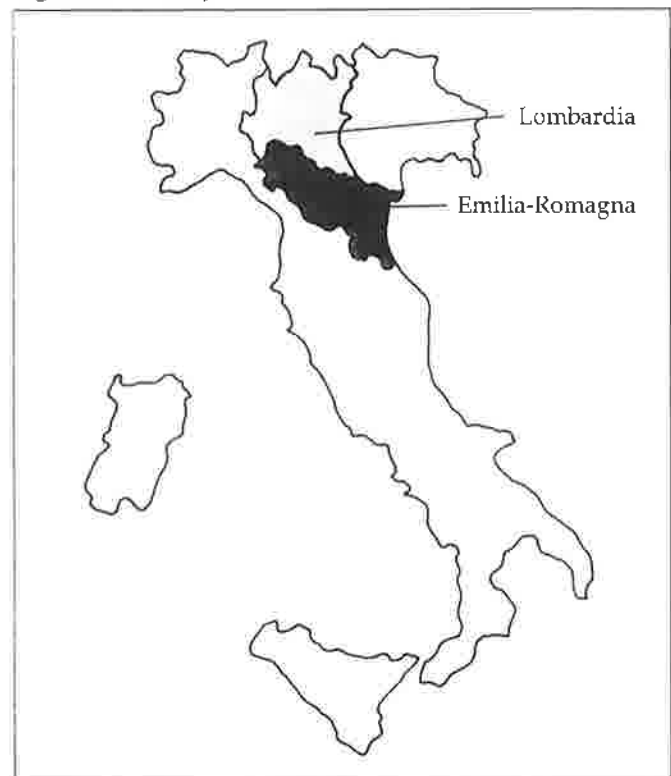
Trade associations and trade unions share economic influence with the governments in the region, the most powerful of which is the National Confederation of Artisans (CNA). It employs 2,500 people in support of the region's nearly 100,000 enterprises with fewer than 24 employees. The CNA maintains offices in nearly every town of 5,000 or more, which makes its services accessible to all parts of the region. Services provided to individual member firms are considerable, ranging from accounting, payroll, taxes, and benefit packages to financing and a wide variety of education and training programs. Labor unions are not particularly strong in the region, in large part because of the small size of so many businesses. One of the benefits of remaining small enough to belong to CNA had been exemption from the laws that protect labor, an exemption that was repealed this year. This had been an important impetus for the proliferation of firms in the 1960s and 1970s. Large producers turned to small—and often lower-wage—firms as subcontractors to avoid union confrontations.

In Emilia-Romagna, associations and regional government have successfully worked together, with perhaps the most successful venture being ERVET (Regional Board for Economic Development). ERVET administers a number of specialized service centers in various parts of the region that support selected sectors or specific needs. Established by the regional government in 1974 as a "joint stock company," it is now co-supported by private sector associations, member firms, and user fees. ERVET's centers include CITER, for knitwear industries; CERMET, for mechanical industries; Centro Ceramica, for the ceramics sector; and SVEX, a cross-sectoral center that assists firms with export marketing.

### **Ceramics in Sassuolo and Fiorano**

Sassuolo, with a population of 20,000, and Fiorano, with a population of 15,000, are located southwest of Modena and represent the head and heart of the world's most important production center for ceramic tiles. Tiles, an ancient art developed by communities of craftsmen and craftswomen in the Middle Ages, are mixtures of clays that are shaped, fired at high temperatures, glazed, and then decorated for use as walls and floors of homes, hospitals, institutions, and businesses. Ceramic tiles are not nearly as popular in America, in part due to differences in tastes and in part to differences in home construction. Tiles are not as

Figure 1 Italy



easily applied to wood, more prevalent in the U.S., as to cement or stone. Thus, last year U.S. citizens purchased only four square feet of ceramic tile per capita, compared to 35 square feet per capita in Italy, 32 square feet per capita in Spain, and 17 square feet per capita in France and West Germany.

More than 100 ceramics firms, located within the *comprensario* formed around these two small cities and their neighbors, produce almost half Italy's output of tiles. What makes this area's economy so complete is the high degree of integrated specialization; firms in all stages and phases of the process—from innovation to market—are located near one another without the need for the immediacy of urban amenities. The area also is home to a large number of firms (see Figure 2) that design and produce equipment used in the industry, that apply design or *terza fuoro*, the third firing, and that provide engineering and marketing assistance. Highways through the towns are lined with factories and businesses bearing names that include the word *Ceramiche*. Italy produces 54 percent of the entire EC output of tiles and 30 percent of the world output, and firms in this single *comprensario* account for 62 percent of all investments in Italian ceramic firms. According to Michael Porter, who highlighted the district in his book *The Competitive Advantage of Nations*, "sophisticated and demanding local buyers and unique distribution channels, and intense rivalry among local

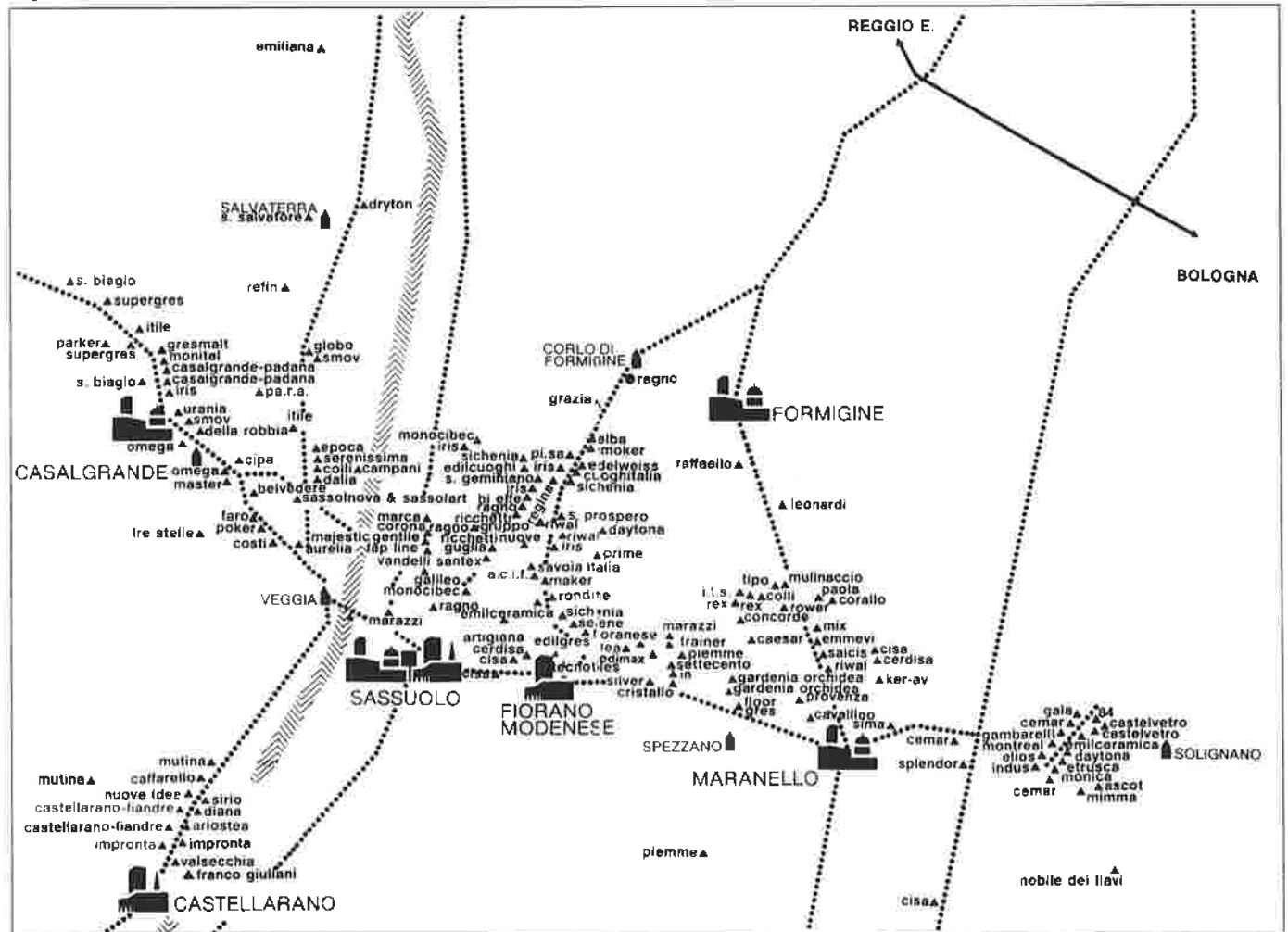
companies created constant pressure for innovation... The geographic concentration of the entire cluster supercharged the whole process." And it happened without recruiting a single firm into the area; nearly every company was built on entrepreneurial efforts of local artisans, technicians, and engineers.

Gabriele Canotti, the general manager of the world's largest ceramic tile production firm, Marazzi, is a former technician who had been encouraged by the firm's owner to return to school (University of Modena School of Economics, *not* Business) in order to prepare for greater responsibility. The owner of the most successful design firm is a young women with artistic talent who started the firm when she was only 20. The president of the most successful equipment producer is a former technical employee of a ceramics firm who had been laid off but used his employment benefits to develop the idea for producing a more technologically advanced type of serigraphic equipment for the industry than was currently available.

Marketing networks also play a significant role in the district's success. Large numbers of specialized ceramic tile showrooms display products for domestic consumption, and trade associations assist with exports. In 1989 Italian domestic sales were \$2.9 billion and exports, \$1.3 billion. In 1985, 80 percent of domestic sales were made to contractors and renovators in Italy's 7,600 showrooms. These showrooms display products for many firms, which fuels competition among firms and drives innovation.

Why did this particular industry develop so highly in these small cities and in this area? First, raw materials were available nearby. Before World War II, the area was principally agricultural and relatively affluent. Large deposits of red clay, which made the land less fertile, stimulated large numbers of traditional ceramic artisans and farm family members to produce ceramic materials to supplement farm income. Second, the few large firms that produced ceramic goods on a large scale closed during difficult economic times, releasing

Figure 2 Location of Ceramics Firms in Industrial District



a number of skilled workers into the work force. Third, Italians have unusually high rates of savings, which were invested in local industry. Even today, the rate of savings is almost 20 percent of household disposable income versus 16 percent in Japan and seven percent in the U.S. Fourth, firms were constantly innovating and searching for new and better methods for a competitive edge. Fifth, technical schools and the downsizing of large firms in the area, including Ferrari, Maserati, and Lamborghini, created a pool of skilled technicians and maintenance workers.

Government policy also played a key though indirect role. Immediately following WW II, the Italian government provided incentives for home construction. Combined with the agricultural entrepreneurship and the skills and technology in the area, it was sufficient to spur production to meet the needs of the booming housing industry. Even today, Italy has the highest rate of home ownership of any European country. One of the first firms to begin producing home tiles was Marazzi, which started in 1950 with technology acquired in Germany. By the 1960s, the industry had expanded from producing tiles for purely functional applications, such as wall and floor coverings in kitchens and bathrooms, to producing decorative tiles and marketing them for use in other rooms. The major mechanized innovations in the factory in the 1960s were automatic presses, equipment to transfer tiles, and new brick kilns. The government also offered tax incentives to stimulate investment, which further encouraged growth.

The next opportunity for expansion, in the 1970s, occurred when process innovations led to more automation. Many plants shifted from a double firing process, in which pressed clay was fired, glazed and refired, to a quicker single firing process in which glaze was applied to the pressed form before firing. Quality suffered but was sufficiently high for home wall applications. Most importantly for competitiveness, the production cycle time was reduced from almost 20 hours to less than one hour. Marazzi was the first company to adopt the single firing process, but innovations are difficult to protect in a tight industrial district. Other firms quickly learned about and imitated the new process. But as production rose with each innovation, so did environmental problems. Pollution created by the concentration of industry soon reached its limits, and new environmental laws had to be enacted to halt formation of additional firms. Unions used the emerging environmental issues to demand that further expansions and new investments be shifted to southern Italy, where unemployment was much higher and unions stronger.

Today, the ceramics district is going through another set of changes that could alter the delicate economic balance. While production continues to climb, employment has dropped—largely due to increased use of new automation technologies—from almost 20,000 in 1978, to 16,600 in 1984, to 14,000 in 1988. In addition, there is a move toward greater consolidation of firms. In 1963, there were 68 final producers in Fiorano, in 1988, 51. Some of the “networks” of firms that had formed alliances are considering merging. The largest group recently merged with Marazzi, and as a result Marazzi has become the world’s largest producer of ceramic tiles and is expanding production outside the region. The company still depends on subcontractors for the design phase and specific production needs that cannot be met, but it is moving towards greater self-reliance and more traditional vertical integration. It is too soon to know what impact such consolidation may have on the district. The majority of firms that fill special market niches, often at the very high quality end, are still small—most have fewer than 50 employees. But officials worried about declining employment prospects are beginning to think about and plan for diversification and the retraining needs of the work force.

Table 1 Numbers of Italian Ceramics Firms by Location

	1973	1978	1983	1988
Fiorano	68	66	54	51
Sassuolo	19	18	23	17
Castelvetro	14	17	17	12
Formigine-Maranello	10	9	9	10
Rest of Comprensario	24	43	34	29
Total Modena	135	153	137	119
Reggio-Emilia	122	116	102	79
Rest of Italy	175	201	142	131

### ***Technology, Innovation, and Entrepreneurship as Economic Development***

Technological advances in production processes, according to an economist, Margherita Russo, are primarily responsible for the innovation that has propelled job and income growth in the ceramics industry and communities. Sources of such innovations, however, lie mainly outside the firm. Ideas have come, for example, from the area’s engineering firms, which experiment with and test innovations inside local factories. Taking advantage of the knowledge and experience of the firms’ employees, engineering

firms can refine ideas before taking them out into world markets, which also gives Italian firms lead time and a unique chance to customize new technologies and add their own innovative adaptations.

Other technologies, according to the general manager of Marazzi, have been purchased from foreign firms, reverse engineered by Italian manufacturers, and improved upon. As Michael Porter points out, "Italian firms in many industries are masters at artfully adapting foreign technologies and applying them to particular end-use applications." They not only adapt them, they produce them. Most of Italy's leadership in machinery has been derived from adapted technologies used in the nation's final production industries. Local entrepreneurs produce needed manufacturing equipment, thereby keeping engineering and production nearby. For example, when the ceramic tile industry needed new brick kilns, the first kiln was purchased from the U.S. Marazzi then signed an agreement with a local company, SITI, not only to produce the kiln for itself and three other firms, but also to alter the design by replacing refractory carriages with rollers, and within three years all local firms were using that same kiln. Now U. S. manufacturers buy the more advanced equipment from Italy. Spray dryers for the powders were first purchased from a Swedish firm, but now are produced locally. But other technologies, such as the seriograph equipment devised by the Systems Group—a firm located in nearby Fiorano—are new to the market, and for a time these new ideas can provide the district's forms with a significant competitive edge.

The other half of the development story is the famed entrepreneurial spirit in the region that gave rise to large numbers of small, artisan firms. A major factor frequently cited is the history of family farms and sharecropping—a system which depended on flexible organizations of labor, which enabled, and sometimes required, family members to take on other jobs, and which resulted in a high rate of savings which was invested in industry. In Emilia-Romagna in 1982, the father of one out of every five artisans and the grandfathers of more than two in five had been in agriculture. In addition government policies encouraged investments and business start-ups, and capital was both inexpensive and relatively easy to obtain.

It is this entrepreneurial vitality that attracts so much international attention and respect. But why is the high rate of business formation so difficult to replicate that not even southern Italy has been able to achieve similar results? First, capital today is more scarce and more expensive, and fewer subsidies for expansion exist except for populations with special needs. Sec-

Figure 3 Relationships in Third Italy



ond, there is a growing sense that more medium-sized and large firms are needed to compete in the common European market and in new global markets. Third, competition is more intense. Fourth, there are fewer children of farmers or farmers themselves who want to make the leap into industrial production. Children of today's capitalists are more apt to stay with their parent's firm and concentrate on acquiring higher quality and greater market share. This is an important point. Maintaining family ownership encourages modernization, whereas if there are no heirs, owners are likely to retain as much of their profits as possible and then sell the business. Moreover, consolidation and modernization in the agricultural sector are reducing employment on family farms. About 75 percent of Italy's farmers are over 55 years of age, and half of those have no apparent heirs. CNA officials warn that the period of very high numbers of new firm start-ups has ended and that fewer and fewer investors will be willing to risk investments in artisan manufacturing firms.

#### *The Elements of an Industrial District*

To function as industrial districts, local economies need intelligence, innovation, capital, production and marketing capacity, and government support. The district has to consider itself an economic entity whose firms are willing to collaborate, but also sufficiently competitive to drive innovation. A brief look at examples of these elements helps illustrate this development model. They include (1) the good-producing firms, including firms that produce final goods and firms that supply equipment, parts, and components to



final producers; (2) service providers—centers for real services, associations of businesses and labor, consultants, and R&D; (3) financial resources—the public sector, banks, and family members; and (4) knowledge sources—R&D centers, universities, technical schools, and training programs. To illustrate the relationships among these factors, three firms (a final producer, an equipment manufacturer, and a design firm), two trade associations, one service center, and two training programs were visited.

**A Final Producer:** Most of the ceramics producers that line the roads connecting the towns are small, but one producer stands out because of its size and influence: Marazzi. Although not a giant by multinational standards, it bears study because of its leadership in innovation and impact on the industry. Just last year, the firm acquired ten other ceramics firms that had been part of a “group,” now merged into a single company. The main plant in Sassuolo employs 1,200 people, and together with a new branch in Dallas, Texas and two in Spain, the company produces 11 percent of the Italy’s ceramic tiles, 8 percent of Europe’s, and 3.2 percent of world production. Marazzi increased its output 31 percent in the past two years by focusing on the medium-to-high quality tile market. Besides household tiles, Marazzi makes very large, industrial tiles (60 cm by 60 cm). It recently signed a major contract with the McDonald’s fast food company for floor tiles for its franchises around the world

When asked whether Marazzi’s recent acquisitions and expansions mark a shift in the structure of the district, the company’s general manager responded no, the highest quality and specialty tiles will remain with small local firms. The low end of the quality spectrum, he speculated, eventually will be lost to nations with lower costs. To maintain and increase market share, the company believes it needs more control over phases of production for which it once depended on others. For example, Marazzi already owns 50 percent of three firms that produce small tiles for them, and it controls other firms that its other subcontractors can work for.

The company must produce an extraordinarily large variety of tiles that vary by shape, color, and sizes. The huge variety, the manager asserts, is required for European markets, not for American markets. For Europe the firm must produce 90 different colors, but for America, only six. Conservative Americans, he notes, ask mostly for “peach, rock, rock, and rock.” But, he predicted, with the growing U.S. Hispanic population that traditionally uses more tile, consumer tastes will expand and consumption will rise. Then,

America’s problem is likely to be a lack of skilled workers who can set the tiles. Too few Americans are being trained to support a large increase in tile consumption.

The factory in Sassuolo itself is very impressive in terms of size, modernity, and neatness. The production process, which is highly automated, appears to be nearly fully automated, from loading clay, mixing, pressing, glazing, firing, packaging, and moving cartons of finished products. Clays are mixed, fed into presses, transported along tracks through ovens, glazed, sorted, piled, boxed, and stored all by computer-driven equipment without a human involved. A solitary woman sits at the line visually sorting to account for variations in color. The entire plant is the length of two football fields, and a small number of technicians appeared to be traversing the factory floor on bicycles monitoring various processes. Every piece of equipment observed, including control panels and gauges, bears Italian nameplates. The most prominent, is *System*, a local firm that produces automated material moving equipment and flexible manufacturing systems.

Marazzi operates plants outside Italy, including a facility that employs 500 people outside of Dallas. General Manager Conotti expressed disappointment and concern about the abilities of production workers employed at the Texas plant. Americans, he complained, are far too specialized and cry for help at the first problem outside of their narrow speciality. An Italian or Spaniard will repair a problem or suggest a redesign to avoid it, he asserted; an American simply wants to change the equipment.

**The “Third Fire”:** A highly specialized phase of production for which Marazzi continues to depend on other firms is final design. About three percent of all tiles sold carry designs that form artistic patterns on floors or walls. The group of highly creative firms that both designs and applies the artwork to the standard finished tiles and is responsible for the third and final firing (“terza fuoco”) constitutes an important final phase of production.

*Ikebana Studio d’Arte* in Sassuolo is one of the most successful of these firms. The modern and attractive building and automated processes reflects the emphasis on art and design of its products. Its president, Isella Malavasi, is a young woman who founded the firm ten years ago at age 20 after completing a design school program. None of the 33 people she employs appear to be older than 35 years of age, and both women and men, blacks and whites are engaged in various tasks from design to production. When asked

how a 20-year-old woman came to have access to the capital and knowledge and risk starting a new venture alone, she assured me that she is not atypical. Young people in Emilia-Romagna are not afraid of risk, she said with some pride. The initial investment, she assured us, was small—the price of a kiln, and she had gone to a design school and thus had the knowledge and skills.

The company today carries out design, mixing of colors, applying designs with serigraphic equipment, firing tiles, repeating with additional colors or patterns, firing again, and packaging. As in Marazzi, all equipment was produced in the area, including controls and gauges. The staff know their market, constantly track style and design changes, and quickly adapt to new trends. Within the *comprensario*, about 30 *terza fuoco* firms who know each other well have formed their own association. It serves both to represent their interests, for example, by controlling prices and preventing dumping, to counter what they consider excessive environmental regulations, and to bargain with unions. But the association also operates as a network, providing group services such as purchasing raw materials and supplies. Further, firms subcontract to each other on large orders (they can only handle about 8,000 to 9,000 tiles per day), and Ikebana works with four or five smaller firms regularly, as well as with customers on quality standards. As a result, reject rates are less than 0.1 percent.

The division of labor, between low-skill operators and high-skill technicians and artists, poses a problem for firms. With so many similar firms so near to one another, workers have a great deal of mobility, and operators, lacking growth potential within small firms, switch jobs frequently based on changing production needs. Designers and technicians, according to the owner, have more growth potential within firms and tend to be more loyal. The most important quality sought in a new employee, she advised me, is creativity—not surprising given the artistic nature of the product.

**The Engineering Firm:** A third category of firms, and perhaps most important from the standpoint of innovation, consists of engineering companies that design and produce production equipment and help design processes. These firms work closely with the *comprensario's* producers of tiles to determine what their problems and needs are and work with them to test new processes.

Among the most successful is the System Group, located nearby in Fiorano. Employing 276 employees, it produces a wide assortment of automated equip-

ment, including equipment for material handling, movement, storage, palletizing, tile sorting, flatness control, serigraphy, and the integrating software to tie it all together. Its state-of-the-art and highly stylized facilities complement the sleek, technologically advanced equipment it produces. The firm also produces a very attractive promotional magazine that combines human interest, politics, and technology—in four different languages. Although its closest ties and strongest interests are in the local firms, half of its production is exported.

The ideas behind System were conceived in 1966 by 21-year-old Franco Stefani, a former electrician at Marazzi with no higher education who had been laid off in an economic downturn. A few years earlier, he and a colleague had devised a mechanized silkscreening process for the tile designs called a serigraph. With knowledge of the process and a vision of the need for more and more automation, and with 175,000 lire in severance pay and one million lire borrowed from his father, he began a small firm called Coemss in a garage with three employees. Its first product was a silk-screen printing machine called "Prackti," and by 1970, with 10 employees, the small company had made and sold 2,500 machines. In 1970, taking advantage of tax exemptions offered in Fiorano because of depressed economic conditions, he founded Sistemi Stefani Elettronica Meccanica System, which later became known as simply "System."

After 1970, sales and employment grew rapidly. In 1982 System employed 118; in 1985, 130; and in 1990 it had more than doubled to its present 276 employees. The work force is young and very well educated; the average age is 30. More than half of the employees have high school degrees and 51 have university degrees; the "public affairs" person who escorted us had a graduate degree in political economics from the University of Modena. Systems invests heavily in R&D—\$400,000 in 1982, \$850,000 in 1985, and \$2,040,000 in 1989. Two years ago, 40 people worked exclusively in R&D. The firm has R&D contracts with the Universities of Bologna and Modena, but lack of confidentiality troubles them, and most of the collaborative R&D is pre-competitive and generic. Perhaps the firm's more important link to the universities is its enhanced ability to employ and subsequently hire engineering students. Ultimately, it is the firm's capabilities in research, management believes, that provides a competitive edge.

According to Stefani, the company's president and founder, there are two reasons for the company's remarkable success. One is the continual research and innovation and search for original products. This

marks a change from the 1950s and 1960s when manufacturers tried to imitate and then improve upon equipment that could be produced locally. The second is that the company concentrates its efforts on R&D, design, assembly, quality control and testing, and training, leaving actual production of parts, components, and assemblies to subcontractors. This, according to Stefani, allows "reduced costs and a notable flexibility, noting that a company structured this way changes from day to day and is "always alive." About 95 percent of the products are customized to the customer's needs.

**The Associations:** Business associations are among the most important players in the Italian industrial sectors. The *Confederazione Nazionale Dell Artigianato* (CNA) is the largest and most influential trade association in Emilia-Romagna, providing valuable services to its 140,000 member firms. The 550 employees of CNA's office in Modena, for example, provide accounting, payroll, taxes, financial advice, and training to 17,000 firms in the province. Membership had been restricted to firms with no more than 23 employees, but last year CNA began recruiting slightly larger firms. That earlier number was the employment level below which the government did not control labor practices, but the law has been revised and workers in firms of all sizes now are protected. CNA and similar trade associations provide a vital collective environment in which owners can meet, common needs can be discussed, and networks can form.

Within the various industries, other associations have formed to serve the industry. *Assopiastrelle*, representing more than 98 percent of all the firms in the ceramics district, is such an association for the ceramics industry. Formed in the 1960s to become the voice for the industry in dealings with government and labor, *Assopiastrelle* also promotes the industry's products. It holds *Cersaie*, the industry's largest trade show, each year (more than 100,000 visitors, including 1,300 from the U.S. last year) and operates trade offices in New York, Paris, and Dusseldorf. Its staff of 30 maintains statistics on the industry, develops standards and norms, publishes attractive catalogues in multiple languages, generally promotes the industry's products, and lobbies for such agenda items as more relaxed environmental laws. It also conducts a training program in international marketing for a small number of qualified high school or university graduates that includes experiences both abroad and in a variety of firms.

**The Public Sector:** Public policies affecting the industry and the towns that depend on it are formulated and implemented by local, regional, and state governments

and, more recently, influenced by the standards and funding opportunities of the European Community. The heart of the *comprensorio delle ceramiche* is Fiorano, a town of about 15,000 situated southwest of Modena and very near to Sassuolo. More than 50 ceramics firms and almost 1,000 other production companies are located within Fiorano's 26 square kilometers. Almost all industrialization has occurred since the 1960s, when the area was still principally an agricultural economy. One reason that Fiorano grew more rapidly than its neighbor Sassuolo was that in 1958 Fiorano was declared economically depressed while Sassuolo was not, and incentives somewhat similar to enterprise zones were offered to encourage business start-ups. In addition, many local farmers, anticipating a declining future for farming, invested in local industry.

Fiorano's mayor, Egidio Pagani, is a young, dynamic and articulate spokesperson with a vision for his community. His background is industrial chemistry, so he understands the needs of the ceramics businesses. His father, a former farmer, had sold his own farm and started a ceramics company himself. Pagani was in the private sector for twenty years before becoming mayor in 1980, and plays an active role in the community's growth. Despite the lack of taxing authority, the city has certain policy tools at its disposal. For example, the city creates a development plan that includes the location of "artisan villages" and environmental protection; it controls infrastructure, such as water, trash collection, and railroads; and it provides social services such as education prior to the public school entry age of six, occupational training, and libraries.

The mayor takes his strongest stand on education. He worries about low level of educational attainment in the labor force—70 percent of the adult population has not completed primary school. Even though education is a state responsibility, the local government believes that it has a responsibility, and therefore Fiorano supports extensive early childhood education. "Teaching" nurseries are available for all children from three months to three years, and 20 percent of all children are enrolled. Schools are available for children from ages three to six that are open from 7:30 a.m. until 6:30 p.m. every day. Further, protected open gardens and toy libraries are available to parents and children. To ensure quality education after age six, the municipality pays for retraining programs for teachers and after-school extra-curricular activities in music, food, and the environment.

Pagani also works hard at bringing cultural activities, sporting events, and museums to the area to make it stand out. One of his most daring and innovative

activities, especially for a member of the communist party, is to give government employees a report card and bonuses based on grades for their performance—a tactic intended to stimulate innovation in what he calls the “whale” of bureaucracy.

Fiorano is an active participant in a large-scale European Community telecommunications project called ESTRICE, suggested and initiated in 1984 when the ceramics industry was in the midst of a decline. University economists believed that the decline was caused by structural changes and thus recommended drastic actions to prepare the area for industrial diversification. The missing ingredient, they believed, was adequate telecommunications. ERVET, the state R&D agency, ENEA, the Regional Government, and private firms collaborated on an elaborate long-term plan. (Part of that plan included the formation of a skill matching center called Dedalo, to be discussed later.) However, market demand eventually picked up again, and the plan never really got off the ground.

How important is telecommunications capacity to the success of the industrial district? Pagani is not convinced that it was needed. He believes that there were too many actors involved, and that a great deal of money was spent because of an inaccurate economic assessment. The ESTRICE project and the EC funding continue, but there seems to be little enthusiasm for it.

The Regional Government in Bologna also influences industrial policy. In 1971, shortly after the Region was formed, one of its first actions was to formulate a development plan based on its small firm economy. The first phase of the plan, put into place in 1976, spurred business expansion. An array of programs encouraged investments and collaborative activities, including grants to buy land, build factories, attend trade shows, purchase or lease equipment, market products, and start new businesses. Consortia were encouraged by requiring that many of the forms of assistance be allocated only to groups of firms. It was during this period that ERVET established its ten service centers. The third phase of development, which began in 1985, focuses on improving quality and on achieving equity—including programs to encourage women entrepreneurs and programs for displaced workers.

#### **The Research Base—A Center for Real Services:**

One of the first centers for industry-specific services the Regional Government's ERVET created was *Centro Ceramica*, a logical choice given the importance of the ceramics sector to the region's economy and the recent establishment of a research center at the University of Bologna. It remains the only ERVET center that is

university-based. *Centro Ceramica* operates with a staff of 40 and an annual budget of \$1.9 million—about one-third for research, one-third for technical assistance, and one-third for other services—and is formally supported by five organizations: the University of Bologna, ERVET, the Emilia Romagna Chamber of Commerce, *Assopiastrelle* (the ceramic trade association), and ANCPL (an association of manufacturing cooperatives). The center has successfully shifted the burden of support from the public sector to consumers, proving its value. In 1976, 85 percent of the budget came from its five members and 15 percent from contracts with industry. In 1989, these figures reversed: 85 percent came from contracts with industry and 15 percent from its five member organizations.

In research, the *Centro Ceramica* has targeted five areas: chemistry, traditional ceramics, special ceramics, e.g., special cutting tools, chips, high conductivity; environment; production; and energy. The most frequently requested technical assistance services is testing for certification of raw and in-process materials and products for European Community standards. *Centro Ceramica* collaborates with five other Italian and five EC standards groups, and the organization's chairman currently chairs the EC internal testing standards committee. This emphasis on testing is evidence of a recent change brought about by a growing desire of firms for a “mark of approval” from the European Community. The Center's second most commonly requested service is advice regarding new technology investment decisions. Special projects also constitute a large part of the center's research. Until recently, according to the director, most firms were not able to articulate their research needs very well, but recently firms seem to have become more sophisticated and there has been a significant increase in R&D requests. The Center is constantly faced with issues of confidentiality when it takes on R&D for firms, and consequently it will not perform similar research for more than one firm except through a joint project. Generally, only the first request is accepted, and firms are guaranteed two years protection for their research projects.

The physical appearance of the Center's research facilities was unimpressive; it did not seem to be particularly modern, particularly given its expressed desire to compete in research in special ceramics for the semiconductor industry. Much of the equipment appeared to be many years old; there were no clean-rooms and little of the state-of-the-art equipment one would expect to see in a firm producing special ceramics. It looked more like a traditional university engineering research laboratory than the high-tech facility described in the brochures, which suggests that

the Center is unlikely to be very competitive in leading edge fields without considerable new investment.

**Education, Training, and Skills:** Although sales of ceramic tiles are rising, labor and government are increasingly concerned about future employment opportunities. Many of the industry's technological innovations are aimed at reducing the two largest controllable costs—fuel and labor. When the single firing process was introduced in the 1970s, for example, 90 employees could produce what previously required 225. Other recent advances in materials handling processes are further reducing the need for manual labor. Retraining the work force, therefore, is becoming more important.

Even though the state provides technical and professional (vocational) training in the district, local government believes it to be inadequate and not sufficiently responsive to market needs. Therefore, the communes support two supplementary and clearly distinguishable training programs: one, called *Cerform*, for those working within the ceramics industry, the other, called *Centro Intercomunale Formazione Professionale*, for those outside of the industry. These programs are supported in the belief that they are more directly market-driven than existing state technical school and university programs and more relevant to local economies. What is left unsaid, however, is that programs are strongly influenced by funding opportunities in the European Community. About 60 percent of revenues come from the EC and 40 percent from provincial and regional governments. In addition to these programs, the CNA operates an extensive training program, called ECIPAR, aimed at small business needs.

Officials of one program, the *Centro Intercomunale Formazione Professionale* (CIFP), were interviewed. CIFP offers three types of interventions or programs. The first prepares graduates of technical schools or universities for the "real" world of work and provides the job specific competencies likely to be required. This program is restricted to people under the age of 25 to meet the eligibility criteria for EC funds, although with local matching funds they have been able to raise the age to 29. The second program retrains employees who have been laid off or hold jobs changed by the introduction of new technologies, the third involves special projects, or training of predominantly female workers from underdeveloped regions outside the EC. This last intervention, aimed mainly at low-skill occupations, emulates a successful French program that focuses strongly on motivation and building self-confidence.

CIFP operates with a skeleton staff of a director, two

section managers, and two program coordinators. The program serves the group of communes, the *comprendario*, but also is under contract to the provincial governments of Modena and Reggio-Emilio. To provide the actual education and training, they rely on local experts, drawing on the universities, firms, and consultants. Enrollments include: 39 percent, new entrants; 8 percent, worker retraining; and 53 percent, special programs. But enrollment-hours, which more nearly approximate the expenditures of resources, are 70 percent, new work force entrants; 7 percent, worker retraining; and 23 percent, special programs. Two-thirds of the students come from the province of Modena and one-third from neighboring province of Reggio-Emilio. Of those from Modena, 77 percent are from the towns of Sassuolo and Fiorano. About 39 percent are unemployed, 23 percent are employed, and 38 percent are still students.

Another related government intervention, *Dedalo*, matches qualifications of workers to jobs. *Dedalo* is a new program devised and implemented in 1987 in response to the economic slowdown in the district (which they knew existed, but no unemployment figures were kept for the municipality). It has been an experimental attempt to rationalize the operation of the labor agency in finding jobs for new or displaced workers. The plan was to collect and compile into a single computer file all relevant information about job demand within both Sassuolo and a thirty-minute commuting radius. However, economic conditions improved soon after the program began, with increasing demand for employees, and outsiders coming into the area to seek work. Local people increasingly seek to avoid the physical labor in many ceramics firms, and it is now going to immigrants. The program is being used and proving useful to firms, but, according to officials, there is less demand for the program than anticipated and in fact was never as effective a tool for reducing unemployment as intended. Economic recovery (with modernization) contributed to reductions in unemployment.

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### **The Mountains of Parma: Outside Still Looking In**

Not every group of rural communities or small cities in Emilia Romagna has been fortunate enough to develop an industrial district or a strong entrepreneurial economy. In some remote areas, jobs are still scarce and youth leave, not drawn to the bright lights of cities but to employment opportunities. The mountain province of Parma, just to the west of Reggio-Emilio, is such a region. The province of Parma has a population of 400,000, including 180,000 in the capital city of

Parma. Some 33,000 firms employ a labor force of 169,000, and in 1987, about 20,000 workers were either unemployed or out of school and seeking their first job.

Relying solely on aggregate statistics to describe economies, conceals wide variations among municipalities within provinces. For example, while the city of Parma and the surrounding area prosper, incomes in the mountain areas are low and industries are few. Much of Parma and the surrounding area is agricultural and the city of Parma's main industry is food processing, but farmers in mountain areas are prosperous by regional standards. Major sources of employment in the mountains near Parma are dairy farming, carpentry, logging and forestry, and tourism, including "agritourism," which involves turning farms into weekend vacation spots. But there are only a few stable manufacturers, including one producing electronic equipment and another producing environmental control technologies for eastern European countries; most industry consists of small craft and artisan firms, of which there are about 400.

Unemployment is not particularly high in the mountains, but that is because so many commute to work. In time, however, many workers will choose to move to cities rather than to continue to commute. The local unemployment that does exist is mainly among women, who are less able to commute because of family obligations. Recently, a few businesses have moved production to the mountains to take advantage of this low-cost female labor force. Unions, though strong in Parma, are weak in mountain areas, which is also attractive to business.

As a result of disparities between strong economies in industrialized areas and weak economies in more remote areas, the Regional Government now requires, although without specific instructions, that all economic interventions give priority to rural and mountain areas. For example, financial grants are available to small towns to retain artisan firms. To protect the environment and maintain the existing culture, grants no longer given for new factories, but a large new regional program provides funds to restore old buildings—factories, farms, and homes—as industrial or business sites or for public facilities.

Another attempt to stimulate the rural economy was the creation in 1980 of a local agency for industrial and social development called SOPRIP, the Parma Corporation for Productive Establishments. SOPRIP is a joint venture that links important players in rural development—the provincial government, municipal governments, ERVET, the CNA, the Industrial Union, the

banks of Parma and Emilia Romagna, and the Chamber of Commerce. SOPRIP's objectives include making sure industries have services they need; supporting entrepreneurship, especially based on indigenous resources; and facilitating planning. In 1988, SOPRIP also added support for service industries to its objectives. This support is intended to spur growth of jobs by developing services; initiating promotional activities; selling information; and operating a Business and Innovation Center to link university research to new commercial opportunities (with EC funds) to promote and incubate innovative firms. One of SOPRIP's newest services is a data bank of economic information. SOPRIP earns operating money from real estate holdings and rental of ten individual business settlements.

Initially intended to attract plants to the area, SOPRIP now assumes that "development does not come from large companies but from indigenous activities." Recruitment was tried briefly in the early 1980s but failed, and today, the main programmatic ideas are linked in some way to agriculture. Current initiatives include developing more subcontractors to supply the food processing industries clustered in Parma, and expanding markets for local dairy products and for mushrooms and strawberries raised on small mountain farms. Another tactic is "agritourism," the development of farms designed to attract weekend vacationers from cities. This strategy has become a major activity promoted region-wide for agricultural areas. The region is becoming increasingly dependent on the EC to spark new initiatives. They expect to get 40-50 billion lire from the Integrated Project for Mediterranean Areas (PIM), and 1 billion lire per year for five years for training programs. All of these funds are funneled through the regional government offices in Bologna.

The major barrier to growth in rural Parma is logistics. Only one train line serves the area; the roads are not good; and there are no telecommunications links, a problem in many rural parts of Italy according to the SOPRIP official, that is being addressed by the European Community. Firms in the mountains cannot compete with areas that are more accessible.

Job training is available in the mountains, although SOPRIP intends to supplement it next year with management and entrepreneurial training. The Barconi Business school at the University of Milano sends faculty to the mountains for short (three-month) programs, and technical and business schools are located 35 kilometers away in the small mountain towns of Ferrago and Buragtorà. In addition the CNA's training arm, ECIPAR, provides courses

targeted to artisan firm owners and potential entrepreneurs.

The main lesson from the experience of rural Parma is that even in the economically vibrant Third Italy, there are areas left behind. Since no data are available, it is not clear whether these economic disparities are only relative to more prosperous parts of the region or there are high levels of poverty. The impression is that economic distress is viewed as relative to the success of the industrial districts rather than compared, for example, to southern Italy.

### **A Quietly Successful Industrial District Outside Third Italy**

Castel Goffredo, a town of about 7,800 is located in the northern part of the province of Mantova in the region of Lombardia, is an industrial center little known outside of the province or outside of the women's hosiery industry. Bordering Emilia-Romagna on the north, Castel Goffredo is not quite within the informal boundaries of what is generally accepted as Third Italy, though it is very close. Not near major highways, transportation hub, or fashion centers of the world, the town would not fit any standard formula for what comprises a technologically advanced industrial location. It looks like many other small Italian towns, with well-preserved stucco buildings, a piazza, numerous coffee bars, and narrow winding streets. But there the similarities end. It is obviously prospering and busy; modern plants are clustered just outside of town, not far from residential areas.

A new and modern hotel that overlooks the area's "big city," Castiglione (population, 15,000) attracts business executives from all over the world. The businesses of Castel Goffredo and its neighboring towns together have created the most powerful concentration of this high fashion product in the world, producing 70 percent of all the women's hosiery sold in Italy and 40 percent of all hosiery sold throughout Europe. Castel Goffredo alone has 1,200 workers employed in 179 firms, each of which contributes some phase of production—knitting, cutting, dyeing, or packaging and selling—to the final output. None is a branch plant headquartered in a distant city. All are locally owned, and nearly all capital comes from local sources. There is a real sense of community and no desire to bring in outside investments. The area is, according to an Italian sociologist studying the needs of the firms on behalf of the local bank, a "semi-differentiated oligopoly." In fact, the relationships are so strong that hosiery firms in France and West Germany lodged complaints with

the EC about unfair competition in 1975. A report was written but no action was taken.

How did these small towns achieve such strength in world markets? In the early 1900s the area was primarily agricultural but featured a large silkworm industry in Mantova. With an abundant supply of water power, Milan and Brescia purchased the silk and became industrial centers for the apparel industry. In the 1920s, the first manufacturing firms, often operated by members of farm families, appeared in Castel Goffredo, and the area soon developed a skilled artisan base with stockings as the major product. In 1927 Noemi, who had acquired his industrial skills in Germany and later moved to Castel Goffredo, became the largest local producer. By 1930, Noemi's firm was employing 300 workers.

Following World War II, an economic crisis in Italy forced many workers either to leave their farms for work in Milan or to find some new commercial activity. Many chose to stay and turned to what they knew best, the production of hosiery. The economic crisis also hit the manufacturers of hosiery equipment, most of whom were located nearby in Brescia, but that reversal actually helped the stocking producers. Low interest rates and good terms made it relatively easy for farmers to purchase equipment they needed from these engineering firms. Many new entrepreneurs began as low-cost manufacturers by using low-wage family labor (as was common in the sharecropper economy) and as a result were able to undercut Noemi's prices. Stockings were not yet part of fashion, and quantity and cost were much more important than quality and style.

The growing artisan firms were so successful that by 1962 Noemi was forced to close. Many of the displaced skilled workers, relying on their craft and skills, became entrepreneurs, starting new artisan industries. At the time there were about three women to every man in the area, and work was divided by gender. Men ran the knitting machines, which required more technical skills, and women did cutting and sewing, which could be done as subcontractors at home. By the late 1960s, government policies encouraged artisans to invest even more heavily in technology and supported the establishment of artisan villages. Further, with agriculture still in decline many farmers were anxious to invest their savings in what they perceived as an industry with greater potential and opportunity than farming. Thus, the combination of (1) skilled workers, (2) farmers with capital to invest, (3) good credit terms from equipment manufacturers, and (4) favorable government policies toward new

factories and equipment led to the rapid growth of the hosiery industry.

Equally important to the modernization of the industry was the development of high quality equipment producers. The first machine company, Lonati, began production in the 1960s in Brescia, only about 25 miles away, and others soon followed. Equipment producers soon built relationships with their customers, the firms of Castel Goffredo, and as these relationships developed the firms began to serve as testing grounds for new equipment and innovations. This gave the area vital lead time in the use of new methods, and at least short-term competitive advantage. The relationship is, as one owner remarked, "like an extended family and the machine producers are thought of as 'local'". Advances in technology made it possible for some firms to grow and begin to produce for final markets themselves instead of supplying other firms, and Castel Goffredo's "marks," or brandnames, became important. As the technology improved, automation of some routine tasks made possible higher rates of production—to the point where overproduction has in fact become a major problem.

Table 2 Number of Hosiery Firms & Employees in Castel Goffredo Area, 1988

City	No. of Firms	No. of Employees	Population, 1985
Castel Goffredo	179	1,194	8,126
Castiglione	43	724	15,885
Medole	36	206	3,150
Casaloldo	35	138	1,824
Ceresara	33	192	2,505
Asola	17	450	8,723
Piubega	22	80	1,698
Solferino	13	297	2,012
Casalmoro	13	135	1,656
Goito	9	106	9,182
Guidizzola	9	88	4,752
Total	409	3,612	59,513
Periphery	22	187	

Source: Costino Cipola, *The Castel Goffredo Model*, Cassa Rurale Ed

The success of Castel Goffredo cannot be explained by production capability and innovation alone. Demand for products also changed, and near the end of the 1960s, as skirts became shorter, pantyhose designed to eliminate garterbelts entered the picture. These new products were immensely popular, and quickly

outsold traditional stockings. In the 1970s, demand was boosted again by expanded notions of fashion design that now included hosiery. The rationale for the purchase of stockings shifted from utility and seduction to identity and image and colors and styles began to be tailored to apparel. This heightened emphasis on fashion led to greater product differentiation and a need for closer production control. Further, some firms were growing strong enough to consider producing for final markets under their own brand names instead of only supplying other large firms. Today, about half of all Italian hosiery is sold through specialty shops, 25 percent through large department stores or chains, 15 percent by traveling salesman, and the rest through other channels.

By the 1980s, the Castel Goffredo area had a firm grip on the European hosiery markets, producing almost half of western Europe's total consumption. Working with final producers and suppliers, they continued to modernize production processes. But new competition, in the low-end lines, from Turkey where labor costs are \$2 per hour and from South Korea, and in the mid-range lines from France and Germany, has been cutting into some of their markets. This competition is pushing local firms more firmly into the upper-middle and high price lines.

### Government Intervention

The growth of the hosiery industry, driven by market demand and market conditions, was bolstered by policies of the Lombardia region. First, the region provided the physical infrastructure, electricity, water, and urban services. Second, laws promoting the re-use of old buildings gave rise to new plants. Third, government provides training through a program called CITE, the Center for Education Innovation and Training. Until five years ago, there were no technical or vocational programs available in the province of Mantova for industry. CITE began offering short, 200-hour courses to workers in the industry in various phases of production, and there is currently a proposal for a 600-hour course for graduates of secondary schools aimed at achieving greater flexibility in all phases of production that would provide a link between classroom education and the world of work.

**A Center for Real Services:** Despite the strong showing of the hosiery industries in Castel Goffredo, there is a lingering concern about increasing competition from Pacific Rim nations and other poorer European Community nations. Business leaders are well aware that Italy now has the highest labor costs in the EC and therefore must be on the cutting edge in technology and innovation. By the early 1980s, competition based on quality was heating up, and the EC was becoming



more actively involved in certifying the quality of its member countries' products. In 1985, a few business leaders began talking about the need for a local center to assist firms with testing materials and certifying products. The center was based on an idea that originated with an economist with the provincial government in Mantova. A study group was formed in 1986 that included representatives of industry and business organizations, municipal and local governments, and the bank. It was pointed out, however, that a glaring omission in the process was that most small firm owners were not members of the associations included and therefore not represented. The main support for the center came from younger and larger entrepreneurs, while older and smaller firm owners remained skeptical.

The key actor in creating a center was the Cassa Rurale Artigiana Di Castel Gofredo, the local rural cooperative bank. This class of banks, which are non-profits and not subject to taxation, are required by law to spend all their funds locally, either through non-speculative investments or by making gifts to the community. To qualify for loans, local people do not need collateral, only two other signatures. Thus, rural cooperative banks have the opportunity to become catalysts for economic development, and indeed in Castel Goffredo the bank operates in effect as an economic development agency. The bank funded the study of the area by a sociologist at the University of Bologna that led to the formation of the new center, and it organized and led the drive to establish a Center for Hosiery Services. In Castel Gofredo, a small study team was formed that included a planner, a government official, an association member, and a trainer. The team began by visiting similar centers, including ERVET's CITER in Carpi, which serves the knitwear firms, COMO, which serves the silk industries, and MINERVA, which serves the textile industries. Twenty firms were interviewed by the team, all customers of the bank and therefore quite willing to participate. Missing from the team, however, was someone expert in the technologies of the industry, and therefore, according to the Center director, the budget included far too little for equipment—only about one-tenth, in his estimation, of what was needed to be a major testing and training center. Next, the bank led the search for provincial support and consensus among local leaders.

The committee that formulated the Center and its mission wanted not only to provide services for the industry, but to create an institution that would strengthen the community and furnish a clearer local identity. None of the firms is large enough to be known individually, but together they believe they will

be able to influence world fashions and markets. The Center began with four major objectives: (1) promotion of quality by testing incoming raw material and final products; (2) provide fashion information, much of which will be purchased from ERVET's CITER, including its computerized design system, CITERA; (3) provide market information including access to high-cost catalogues and studies of market trends and encouraging joint trips to trade shows; and (4) training, primarily for entrepreneurs in marketing, strategic planning, and other management functions.

The regional government is funding half the purchase of the Center's equipment under Law 33, the provincial government allocated \$80,000, and the bank provided the new building. Each association paid \$8,000 to join and has committed another \$4,000 per year. Individual firms can join by purchasing shares; the amount required is based on sales. For example, a firm with sales of less than 500 million lire would pay about \$160, and a firm with sales of between one and three billion lire (about \$800,000 to \$2,400,000) would pay about \$320. The Center's budget for the first year is \$260,000 (with the facility provided free of charge from the bank).

#### *Inside the Firms*

What kind of firms and people can retain so much control over markets from locations so isolated from markets, transportation, and schools and with some of the highest labor costs in Europe? Two locally owned and managed firms were visited, Mura Collant with 160 employees and Calza Levante with 140 employees. These two producers, both of which sell under their own labels, are among the largest firms in the hosiery district. (The largest firms are DIM, Filc doro, and Golden Lady.) The general managers of both are relatively young, educated at University of Milan's Boconi School of Business, sons of the founders of their respective firms, friends of one another despite the fact that they compete for identical markets, and equally supportive of the new Center.

**Production:** Even though the firms in the hosiery district produce two generic products, stockings and pantyhose, they must be flexible enough to respond to fashion changes. The variations in style, colors, and sizes amount to about 23,000 various combinations. Delivery of any particular combination is guaranteed in one month. To meet demand, the entire production process is highly mechanized, much of it is automated, and the inventory system is computerized. To meet production schedules or for relatively small production runs (less than about 2,000 dozen), however, some work still is subcontracted out to smaller firms that specialize in single phases of production.

The process includes knitting two white tubes, sewing them together, adding the decorations, assembling the parts, steaming the product, inspecting for imperfections, dyeing, pressing, and packaging. Computer-assisted equipment is not programmed or maintained by the operators, most of whom are women, but by technicians. All of the equipment, from the gauges and controls through the machinery, bears Lombardian name plates—companies from either Brescia or Milan.

**Market Penetration and Outlook:** The two managers, who recently traveled together to a trade show in North Carolina and visited rural southern firms, are convinced that they are far ahead of their American counterparts in terms of manufacturing capability and innovation. Yet they have not been successful in penetrating U.S. markets, because, they claim, American markets are so fragmented. In France, they only have to deliver to three locations to reach all French markets, but they would have to negotiate with large numbers of distribution points in the United States. Instead, they turned east and have just begun to jointly trade with Japan through an export firm in Milan.

The manager of Levante was much more pessimistic about the district's future than the manager of Mura and also more interested in reversing the decentralization that characterized the area's early production. "Decentralization of production was and is the region's advantage, but will it be tomorrow," he asked? In his mind, the answer is "no," and he is moving toward control of as many phases of production within his facility as feasible. Splitting phases of production, he stressed, is a sign of weakness. Further, he stated, as technology advances a firm has to become larger to justify the investments. Firms with low volume cannot purchase computer-controlled equipment.

The region's weakness, in his view, is marketing. He believes that local firms are well ahead of their competitors in technological innovation and in quality but lag behind in marketing capability. He worries about consolidation, as the EC moves toward a single market and world markets expand. Apparently influenced by the recent trip to the U.S. South, including visits to large Hanes' branch plants, he wondered whether the 30 well-known labels on the market today will become 15 tomorrow and whether his will be one of them. Losing the Levante "label" is as dire a prospect as losing sales, and he did not wish to return to the days when the region's firms supplied large companies elsewhere under their labels. His fears, however, seemed somewhat premature, as Levante's sales have doubled over the past two years and the production of the entire district is rapidly growing.

Both managers are strong supporters of the new Centro Servizi Calza, and Michele Mura serves as its first chairman. The most pressing need of both firms is testing and certification, although the manager of Levante also looks forward to better information about fashion trends and hopes the center will soon have a data bank of fashions, such as CITER offers knitwear firms.

**Another View—Organized Labor:** Labor union officials from Milan and Montova paint a quite different picture of production and working conditions in the Castel Goffredo region. They charge that young women are being recruited out of school to work at the plants, that immigrants from non-EC countries are working there while some local residents are out of work, that there are no vocational schools in the area, and that women are channelled into low-skill jobs with limited futures and change jobs frequently, while men are technicians, work on the more expensive machines, and have much greater opportunities for further education and advancement. In addition, they claim that noise levels are dangerously high, that because it is too costly to stop the machines they operate 24 hours per day, and that the "check system" in which women work four hours, take four hours off, and work four more hours is overly taxing. As a result, they would very much like to organize the workers in Castel Goffredo. But as long as wages are good, and people choose to work second or third shifts (at even higher wages) and under the "check system," it seems unlikely to happen.

### *Lessons From Italy*

Can *Terza Italia* be used as a model for the United States? If it can be, is it a valid model for lesser populated areas? And, if it cannot be, are there lessons that can be learned to help rural American firms operate more competitively? How influential is the role of government? These questions are increasingly being asked in the United States as more and more people become aware of northern Italian's success.

To understand the potential of a small firm economy, it is necessary to review the individual characteristics of industrial modernization and development in northern Italy and compare those characteristics to those of the United States. The most important factors in the success of northern Italy are cost-efficiencies and expanded markets achieved through collaboration among small and medium-sized firms; strength of numbers and self-sufficiencies of industrial districts; and a high rate of industrial innovation.

The first, and most newsworthy and intriguing, characteristic is the proclivity of firms to join forces, to

form what are popularly termed networks in the United States. Ever since Sabel and Piore brought the story of the Italian artisan firms to the attention of the American public in *The Second Industrial Divide* in the mid-1980s, flexible manufacturing has become part of industrial policy language. The concept was expanded to flexible manufacturing *networks* shortly after their book was released, when the importance of relationships among firms became better understood. Skeptics of replicability charge that American firms are too competitive and American family and community structures too weak to support such cooperation.

Certain conditions in Italy exist that foster collaboration and networks. First, firms are for the most part owned locally, and owners know one another and each others' families. Undergirding this is a willingness of local people with capital—farmers, artisans, and industrialists—to consider the larger benefits to the community in addition to the benefits to the firm. On balance, they will pay more to keep business and capital within their own community, purchasing as much as possible from local firms and investing locally, at times even if higher returns are possible elsewhere. Local ownership and capital are part of the region's social and economic history, which is different from experience in the United States. Perhaps the most important difference is in the attitudes of farmers. Whereas in Italy, farmers' political, social, and economic alliances are with their communities, in America, alliances are more likely to be made within the agricultural industry itself.

Another condition is widespread membership in trade associations, which meets common needs and provides an environment in which firms get to know one another; the associations provide the glue that binds firms together. Group services such as accounting, capital acquisition, and training provided by the trade associations acclimate firms to shared activities. Furthermore, some government programs, to maximize impact, make collaboration a condition for eligibility. Government programs typically are designed to alter market behavior, not intended to be permanent subsidies. Programs are implemented as part of long-range development plans, and once their objectives are achieved, they end. These two conditions, trade associations and government incentives, could be replicated in the United States, with associations providing needed services and settings, and government policies fostering collaboration.

Industrial districts may be the most difficult trait to reproduce, at least in the concentrations that typify northern Italy. While American analysts focus on networks, many European economists believe that the

industrial district is the most unique feature of *Terza Italia*. Industrial districts are not unknown in the United States; in the nineteenth century many industrial sectors were concentrated in specific areas—paper companies around Lee, Massachusetts; machine tool builders around Springfield, Vermont; steel around Pittsburgh; and food products around Chicago. The difference is that in the natural course of maturation, American industries moved to favorable locations where factors of production were least costly, while in Italy they remained concentrated. That may be a difference between a corporation responsible to stockholders and a family business responsible to a community. Industrial districts could be developed in the United States, if policymakers were willing to wait as long as it took in Italy—which is about the same time it took Research Triangle Park to move from undeveloped real estate to a burgeoning R&D center, about thirty years.

Yet another characteristic of northern Italy's success is innovation and modernization. How do small Italian firms, many of which have no designated R&D functions, manage to be so innovative? First, consider the relationship of firms to equipment producers. Through close personal and working relationships with the firms that produce equipment, Italian firms are always a step ahead of their competition which has to wait for new technologies to be fully tested and reach the market. In the ceramics and hosiery districts, equipment producers operate as extensions of production staff, testing new ideas on the shop floors. American firms, in contrast, purchase equipment from all over the world, and it is doubtful whether they would have the resources or patience to produce critical process equipment locally. Second, close ties among firms and their work forces make it difficult to keep an innovation confidential, and this leads to rapid diffusion and imitation. Thus, local competition drives further innovation if firms expect to maintain market advantage. Third, Italian producers maintain close relationships with their customers and solicit their suggestions, which also drives innovation. Fourth, by remaining small and having the trade association perform so many routine functions through centers that provide real services, they can concentrate on production. Fifth, it is not the skills of the operators, at least in the two districts observed, which make the difference. New technologies appear to require less skill than routine work done in final production firms, while requiring greater skills from technical, maintenance and supervisory staff. In some instances, the technicians and maintenance workers have become entrepreneurs, starting new firms based on specialized skills. Innovation is slower in the U.S., according to Italians, because technicians and maintenance workers

are not as well or as broadly trained. In the firms that do more customized work, such as “third fire” design firms or equipment manufacturers, workers were observed to have more influence over the production process and greater opportunity to be innovative, and the availability of broad-based and continuing technical training is believed to be a contributing factor in extensive modernization.

Rural conditions have not seemed to inhibit successful development, although extreme isolation can. In fact the cohesiveness of the small communities and the agricultural economic base that existed as recently as the 1960s have been important factors in growth. Today, however, most of the major industrial districts in Emilia-Romagna are located within 50 kilometers of a major highway corridor running across the region. The ceramics sector is located in small cities near high population density centers. The hosiery district of Lombardia is located in even smaller cities within a less densely populated area than the Emilian districts, but it is still an easy drive from the medium-sized cities of Brescia and Mantova. The mountains towns of Parma, which are more isolated from cities of any significant size, have not exhibited the same kind of innovation, networking, and concentration.

## Denmark: Information & Production Networks

Even the most fervent admirers of Third Italy's industrial renaissance question its replicability in other social and economic settings. Denmark is the first nation trying to reproduce the success of flexible manufacturing in Third Italy but adapting it to its own circumstances. Lacking raw materials to support a strong industrial base and "industrial locomotives," Denmark has not developed notable industrial districts, and is home to very few multinational corporations or industrial giants. Over the past decade, Denmark has turned more and more to science and technology programs as its sparkplugs for economic growth. But to exploit the benefits of technologies developed, it realizes it needs to build and sustain a stronger industrial base.

The same accounts of Third Italy's development that reached the U.S. also left their impression on the Danish government. After investigating the process in some depth, Denmark made a decision to go all out to introduce flexible manufacturing networks to Danish industry as a new approach to industrial policy. The Danish experience, which began in early 1989, provides valuable experience to those interested in the replicability of Third Italy.

Denmark is a Scandinavian nation of 5.1 million inhabitants bordered on the south by Germany and on the other three sides by the North Sea. Its capital and hub city, Copenhagen, is only a short number of nautical miles from the Swedish industrial city of Malmö. Most of the country's population resides on the island of Zealand, which includes the capital city of Copenhagen and Jutland, a peninsula on Germany's northern border.

Denmark, the only Scandinavian nation that belongs to the European Community, is also one of its smallest member and has no pretensions of becoming an industrial power. With a large fishing and agricultural sector, food processing along with furniture and textiles have been its staple industries. Most of its firms are small, specialized, and vertically non-integrated, also characteristic of industry in northern Italy. More ninety-eight percent of its industrial work force are employed in small and medium-sized enterprises (SMEs), a higher proportion than any other western European nation.

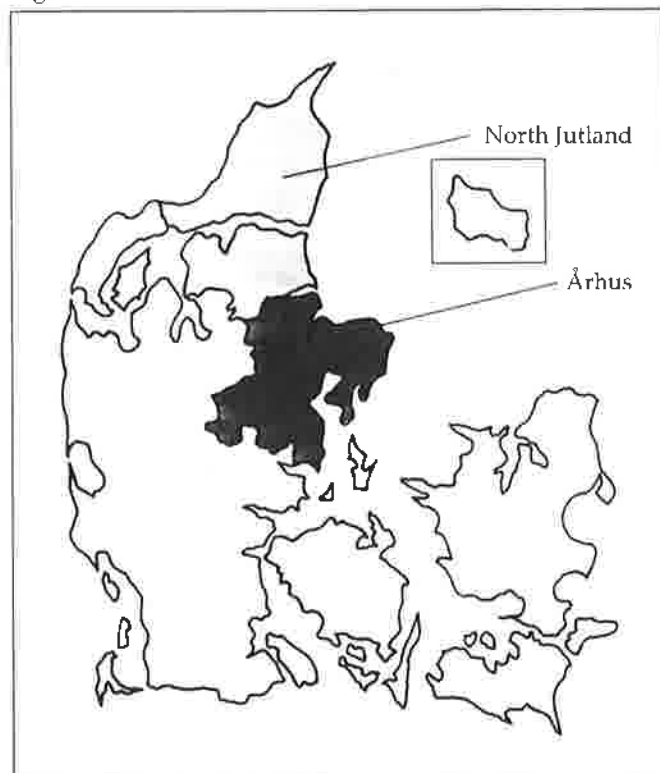
To get the most from this small firm economy, Denmark draws on its advantages. One is a strong education system and high literacy rate. Denmark's education system, among the most innovative in the world,

includes a good primary system in which every child takes five years of English and three years of German, an excellent network of commercial schools and technical colleges that integrate apprenticeships with classroom instruction, and the famed Danish Folk Schools, which offer free adult and continuing education. The academic year for Danish youth is more than ten months long, giving each student about 20 percent more instruction per year than the average American youth.

A second advantage is a long tradition of high quality product design, craftsmanship, and cooperation. Denmark's cooperatives grew out of its agricultural system much as American agricultural cooperatives did, but unlike the U.S. system, Danish traditions carried over into manufacturing. Cooperatives today provide group services for many similar firms, in part because of the small size of so many Danish firms. About 78 percent have fewer than 50 employees, and 95 percent have fewer than 200 employees.

A third advantage is a long history of selling products in foreign markets. With relatively small domestic markets, Danish industry has been forced to look to external markets and to excel at exporting. Last, the

Figure 4 Denmark



government has been innovative, most recently, concentrating considerable resources on developing expertise in information systems. Denmark hopes to position itself in the European Community as one of the leaders in information technologies and in the coordination of business transactions, such as joint marketing and licensing agreements among nations.

To stimulate technology-based growth, the Danish Ministry of Industry and Trade has taken a proactive role. As a result, Denmark has what may be the most intensive infrastructure for technology development, transfer, and diffusion in Europe. This nation, which has one-third fewer people than the state of North Carolina, has five research universities, a large technological institute with facilities in Århus and Copenhagen, 23 advanced technology centers (ATVs)—often referred to as “know-how” centers, 15 Technical Information Centers (TICs), 82 local technology centers, and a large number of private consultants and network brokers to assist the nation’s 6,800 mostly small and medium-sized manufacturers to compete in world markets (see Table 3). Most of these support agencies, which were started with state funds, expect to market enough services to become self-sufficient. But there is growing concern that this array of services is excessive, and that none will be able to grow strong enough to be recognized within the EC for its excellence. Eventually, some officials privately concede, there will have to be some consolidation. In early 1990, in fact, the two technological institutes merged into a single institute, *Dansk Teknologisk Institut*. By consolidating, it has become the fourth largest institution of its kind in Europe. Many believe that the 23 ATVs also will be forced to consolidate, most likely into three to five centers,<sup>1</sup> and that due to insufficient market support, many of the 82 local centers will close when their EC support expires.

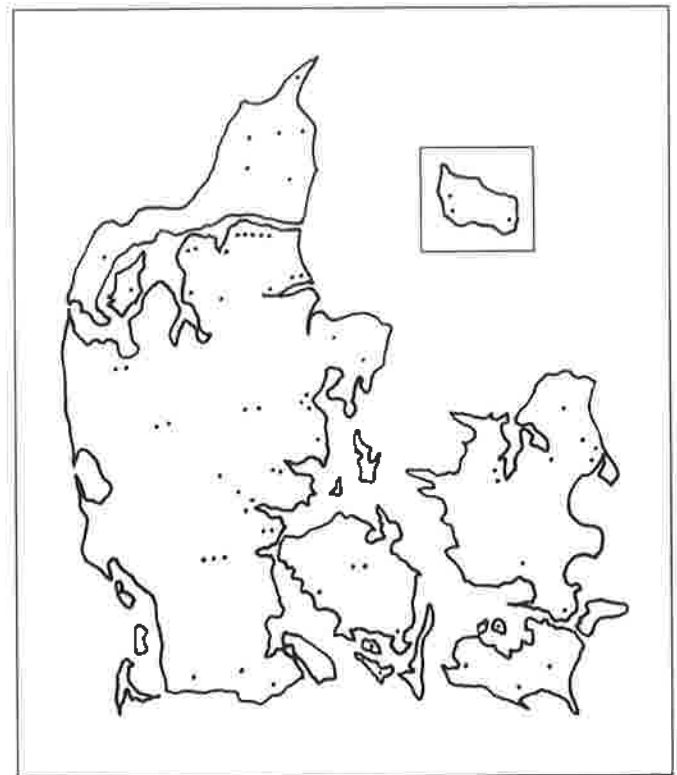
The remainder of this section will describe in detail three strategies that are representative of Denmark’s industrial policy, the conditions on which they are based, and assess the potential for success and for

Table 3 Danish Applied Technology Infrastructure

Provider	Focus
5 Research Universities	Regions
1 Danish Technological Institute	State
23 Advanced Technology Centers	Technologies
15 Technology Information Centers	Counties
82 Local Technology Centers	Municipalities
40 Network Brokers	Local

replicability of each. The first is the NordTek program, created with EC support in 1986 to improve the economic base of North Jutland county through local centers intended to spur greater use of information technologies and technology-based product development. The other two are the Danish networking program, modeled on the flexible manufacturing networks of northern Italy, and a new program, still in the planning stages, to spur economic development in Djursland, a poor and rural part of Århus county.

Figure 5 The Location of Technology Centers



**Industrial Policies:** In the mid-1950s much of Denmark’s job growth was concentrated in and around Copenhagen. In 1958 the government adopted an Act of Regional Development to achieve a more balanced growth by enticing firms from the Copenhagen area to smaller cities with subsidies and low wages. European nations do not shy away from industrial policy. In Denmark, as in Italy, regions and municipalities have no tax base from which to offer subsidies, but the state also prohibits such competition for industry (as do many U.S. federal economic development programs, but the prohibition is rarely enforced). But Denmark is allowed to provide subsidies that redirect employment to meet national objectives. Under the 1958 Act, each Danish municipality established an industrial council composed of local business leaders and government officials and supported by government, and each hired a chief of industrial development. A few towns were

able to attract firms, but for the most part labor costs were not low enough and urban-rural and other spatial differences not large enough to influence long-term plant relocations. If wages were an issue, they believed, branch plants would be apt to relocate. But Denmark very early learned what the U.S. is now learning—that jobs based on wage differentials are footloose. That epiphany eventually forced the state to try other strategies, especially when the economic crisis of 1974 hit. The role of the more innovative chief industrial officers shifted to that of broker or, as an official termed it, “sparring partner” to help smaller firms solve production problems and expand markets.

The role of state government in using technology to stimulate economic development has grown quite large. In 1987, for example, the National Agency of Technology spent more than \$40 million on infrastructure. Furthermore, from 1965 until 1989, government programs promoted greater export and market development through 35 Danish trade officers located in 22 countries. Concurrently, programs to encourage product or process development were started, beginning with loans in 1967, grants for up to 40 percent of the development costs from 1977, and a technology scout program to look for R&D results with commercial potential. Between 1985 and 1988, 1,051 product or process development grants totalling \$65 million were made to individual enterprises and 706 grants totalling \$100 million were made for joint solutions to problems. The funds to enterprises were allocated according to the percentages shown in *Table 4*. More than \$30 million was allocated to the ATVs (“Know-how Centers”) for new equipment. And through a technology scholarship program, engineers and scientists were supported for study abroad. Under a new Minister of Industry and Trade, those programs were abolished in 1990 as part of larger shift in policy away from government grants.

In the early 1980s, additional programs founded on both increased use of new technologies and collaboration were designed and implemented. For example, three or more firms could secure funds to engage a foreign expert to address technological problems, and

**Table 4** Distribution of Technology Development Funds, 1985 to 1988

Category	No. of Grants	Percentage of Total
Product Development	452	39
Process Development	211	19
Software Development	388	42

six or more firms could obtain funds to tour foreign R&D centers or visit foreign firms. Funds also were available for technology fellowships, trade in technology, and cooperative R&D between universities and firms. In 1982, the government began a new program to provide information about patents and licenses, as well as introduce worthy ideas to promising business contacts. In 1984 the Ministry of Industry and Trade initiated an entrepreneurs program and opened the first Technology Information Centers to broker information to entrepreneurs and SMEs. This approach represented a new concept in public policy; in fact, the Danish language did not even include a word for entrepreneur. The English word had a very different meaning in Danish, i.e., a large building company, so it could not be adopted. To be able to talk about the process of starting a new business, a group of analysts invented a completely new word, *loerksaetter*, now commonly understood to mean entrepreneur.

By 1986, Denmark’s industrial policy emphasized technology, export promotion, better access to information, and small manufacturers. The programs were market-oriented and geared to stimulate new activities. Further, enterprises were expected to bear the expenses for projects which would have been carried out even without support. With the shift to technology, were resources more likely to remain in the Copenhagen area, where the high-tech firms are most heavily concentrated? Most of the program funds have been relatively evenly dispersed, and without any apparent special targeting. The one exception has been the entrepreneurs program, where most of the 61 individuals awarded two-year scholarships to develop their ideas have been from the Copenhagen area.

### **NordTek: A Program for Local Development**

Despite a relatively high standard of living in Denmark, there are pockets of unemployment and low income. One of these is North Jutland Amt, the county on the northernmost tip of Denmark, which reaches out into the North Sea towards Norway and Sweden. About one third of its 480,000 people live in the city of Aalborg, and the rest are scattered among the county’s many small cities and towns. For many decades its economy was based on agriculture and fishing. Only recently has it become industrialized, but it still lacks any strong industries, save for its declining shipbuilding industries.

In 1972, the county asked the state to turn the college in Aalborg into a major university as a local economic development strategy and to provide opportunities in higher education for local youth. The government

liked the idea, but instead of allowing local people to control the design, it turned it over to "traditional educators in Copenhagen" more bent on creating a traditional college for the liberal arts and sciences than programs responsive to local needs. It has taken, according to a member of the planning commission, more than a decade to bring the college back to an economic development focus. Today, the Business School and the Institute for Production in particular, work with local industries and are catalysts for local development initiatives. Still, according to local officials, with economic opportunities in short supply, this renewed emphasis on pragmatic programs has not stemmed the outmigration of youth seeking greater opportunities; it has only delayed it by four or five years until they graduate.

Because of the county's high unemployment rate and low per capita income compared to the rest of Denmark, North Jutland County is eligible to tap the European Fund for Regional Development (EFDR), and in 1985 the county turned to that fund to modernize its industrial base and move its firms into the mainstream of technological change. The Industrial Council of North Jutland County brought together the major actors in economic development, municipal development officers, the County Council, TICs, trade unions, vocational schools, and the University of Aalborg to develop a proposal. Its primary objectives were local initiatives to speed innovation and modernization in small and medium-sized businesses through broad access to information technologies, to spur new product development, and to attract Norwegian and Swedish firms that might benefit from operating within the European Community. These strategies would, the county's proposal asserted, be expected to create 4,500 new jobs within the five-year life of the program. The program, which was called NordTek, was established in 1986.

The final proposal was not entirely satisfactory, according to a consultant who helped devise the plan. To be funded, it had to conform to EC regulations and goals and, as he recounted, "by the time the 'Brussels machine' was finished, it was not the plan the committee originally conceived." For example, EC dollars had to be matched with local government dollars, not with private sector support as originally desired and therefore expenditures had to comply with government guidelines. This requirement limited expenditures mainly to infrastructure and equipment. The original concept also had closer links to individual firms. A key member of the planning committee, according to one critic, was a bureaucrat primarily interested in rules and regulations and how the proposal fit with national programs, not how closely it

met local needs and interests. In 1986, with a great amount of fanfare and an extended promotional campaign, the program began. At first, it used a NordTek bus travelling from city to city to raise the program's visibility, answer questions, and pique local interest.

The main strategy of NordTek was "to let 100 flowers bloom," to try an array of initiatives and see which proved most effective. About 65 percent of the funds were set aside for local initiatives designed by local officials and industrial councils, and 20 percent was designated for specific projects of SMEs, e.g., to import or license technology, to procure information, or to improve industrial design. Once the program was announced, local authorities immediately set out to formulate local programs to fit the criteria and compete for the funds. More than 10 local projects were selected and awarded from one million DKr to 12 million DKr for efforts that began before January 1987 (see Table 5).

Most of the "flowers" were new or expanded centers for services to speed modernization. This not only fit the program criteria and allowed expenditures in facilities and equipment but also fit the state's recent

Table 5 Typical NordTek Programs

<i>Farsø Business Development Center</i>	New technologies for furniture industries
<i>Hobro Microcomputer Center</i>	Expanded use of microcomputer expertise by industry
<i>Hadsund Technology Center</i>	Increased utilization of CAD/CAM and technical training
<i>Sindal TekNord</i>	Shared technology managers' program
<i>Aars Trade Center</i>	Promotion of international trade, technological advances
<i>Aalborg Science Park</i>	Science and industry park facility near University of Aalborg
<i>Brønderslev Information Technology Center</i>	Training in use of new computer technologies
<i>Saeby Innovation Center</i>	Assistance for innovators with product development



interest in such centers. A new Danish scheme in 1987 provided funds for 16 information technology centers, and about 60 centers have opened in Danish towns since 1982. Can a local center spur economic growth through its technological services, or is a center simply a way to take advantage of government funding opportunities? What features seem to affect the success or failure of a center in a small city? Directors of two centers and a consumer of services from another were questioned about the impact of projects. The first was a newly combined center for information technologies and training at Hadsund, the second a sector-specific business assistance center at Farsø, and the third a technology managers' program at Sindal.

#### **Hadsund Education and Information/Computer**

**Center:** Hadsund, a small city in the eastern coast of Jutland, was a vibrant agricultural center of commerce just twenty years ago. Today, however, more than half the work force is employed in manufacturing companies, nearly all of them started by local people; more than 300 small manufacturing firms dot the countryside. Only one manufacturer has more than 500 employees, and only a half dozen have more than 100. Low-interest loans and regional development funds provided incentives, but the product ideas were homegrown. On the edge of town is a small office park that represents Hadsund's response to economic changes and public opportunities. This facility, built and equipped with the help of more than five million Dkr from NordTek, houses the Hadsund Education and Information Center.

The project began with an educational center. Despite the growth of industry without any local public education beyond primary school (grades one through ten), local leaders were well aware that such educational deficiencies would eventually hurt local competitiveness and concerned about the ability of local firms to modernize without improving the skill level of the labor force. Noting that employers recruited skilled labor from outside the community, which meant that increases in employment failed to reduce unemployment, officials proffered an idea for an educational center. In 1980, the Industrial Council founded the Hadsund Education Center and made its first priority acquiring a training capacity. A branch of the Aalborg School for Unskilled Workers opened in 1982, and two years later a branch of Aalborg Technical College opened to provide technical education. The programs still were not reaching the least qualified unemployed workers in the area, many of whom were female. Thus many of the unemployed still lacked the skills and qualifications firms wanted.

When NordTek was announced, the community saw

an opportunity to obtain additional funding for programs for the structurally unemployed. First, the Center started a 25-week program for unskilled, structurally unemployed workers that includes two to four weeks as apprentices, and another program to train 150-200 female clerks in electronic data processing. Another project, called TIME (Implementation of New Technologies in Smaller Firms), takes 24 qualified clerks through a ten-week general education course, places them in a firm for one week to make an analysis of the firm's technology needs (in administration, inventory control, etc.), sends them back to the Center for ten weeks addressing the problems they identified, and then places them for three months in the company, paid by the state with unemployment wages. The ERDF funds funneled through NordTek provide half of the administrative costs needed to operate the center, including staff salaries.

In late 1987, the community again responded to opportunities afforded by NordTek and the ERDF. The Hadsund Industrial Development Council requested NordTek funds to establish a parallel Technology Center to support firms with consultants to help with new production technologies such as CAD/CAM. The Technology Center, with four consultants on staff, offers management education and technical assistance on production issues. The training programs open up contacts with business, and a few interesting projects are already underway. One is a production control system that may evolve into computer-integrated manufacturing (CIM), another addresses problems that arise when new technologies are introduced without foreseeing the organizational implications. The solution will likely require reorganizing the firm. A third involves new applications of bar codes.

This center, like others in Denmark, aspires to be self-sufficient. In fact, in 1988 the center became a company to avoid having to return its profits (funds earned) back to the Council. This, the Board thought, would improve relations with firms. But its management also realized how unlikely the new company was to become profitable based solely on serving local markets. Therefore, it began aggressively pursuing alternative clients not only outside the Hadsund area but also outside of Denmark. It already is involved setting up a CAD/CAM center in Ireland and expects to sign a contract with the Polish government for a center for unskilled workers to renovate agricultural equipment and develop the capability to repair equipment locally. The Center also participates in and hosts international seminars, and serves as an incubator for technology-based firms. At present there is one tenant, a young entrepreneur with a design for a tool he would like to produce locally.

The establishment of the Technology Center along side the Hadsund Education Center created two centers with overlapping responsibilities and services, many aimed at the same firms. In 1989, the two boards and two managements proposed and accepted a merger into a single Center with two divisions. The new structure provides an eight-person Board consisting of representatives from the Business Council, the local Council, unions, and employers' organizations plus a manager with two operating divisions, the Technology Center and the Course Center. According to the NordTek evaluator, the local businesses now believe that the Center strengthens their community; they are invested in it and are willing to pay for its services.

**TekNord—Innovation from Within:** TekNord, one of the county's most innovative approaches to modernization, is not a program in the usual sense. Its facility is simply an office in Sindal, a small, rural town in the northern part of North Jutland County. What makes the program unusual is that the services provided are delivered from inside firms that seek help. The program employs seven experienced industrial managers who contract with SMEs for between 10 and 20 percent of their time over a period of 30 months to help them innovate and modernize. Each manager, therefore, might work with between five and ten different SMEs. By mid-1988, all of its "managers" were fully subscribed. Costs of managers are shared between NordTek and client firms in proportions that shift each six months, from 25 percent from the client firm for the first six-month period up to 75 percent from the client firm over the fifth six-month period.

The aim of the program is to introduce new ideas to small and medium-sized firms and provide a network among the managers for solving problems and suggesting innovations. Most observers, as well as a NordTek evaluator, believe that this program is a success. The view of a client, Roblon Engineering, may tell a more useful story of how the program works from inside and how an SME in a small Danish town has been able to achieve a modest degree of worldwide success.

Roblon Engineering is a medium-sized firm headquartered in Fredrikshavn. For many years it produced twisted ropes for the fishing industry. Rope-making, like cigar-wrapping, is an unskilled, low-wage business, and thus many of its strongest competitor firms are located in lesser-developed countries. Roblon, realizing that it had more skill and ingenuity than most of its competitors, and decided to convert that advantage into a new business opportunity. Twelve years ago, the company decided to produce and improve upon the equipment used to twist and coil ropes

mechanically and established a new branch called Roblon Engineering. The new plant located in Saeby, a small city of about 10,000 on the eastern coast. With loans subsidized at about half the commercial rate, a grant that covered 40 percent of the product development costs, and land that had been set aside for industrial growth, the firm began construction. The firm showcased its equipment for the first time in a textile exhibition in Greenville, South Carolina in the late 1970s. Now, a decade later, Roblon has become one of only three remaining companies in the world that produce machines to twist and coil ropes, their niche market spanning the entire globe.

The firm employs 75 people in its engineering division, including six college-educated engineers and four college-trained technicians. About 60 are employed in Roblon's other two divisions, one for rope production and a new ballistics division making material to absorb shock. The engineering division is actually a shell in which design, engineering, assembly, testing, and shipping take place, but it performs no actual metal work. All parts and components are purchased through competitive bids from local suppliers. About 80 percent of each machine is standard, and the remaining 20 percent is custom-designed.

The employees in the engineering division are all highly skilled and freely discuss production problems with management. Roblon's manager was unable to understand why American technicians cannot do the same. His American customers have more servicing problems and purchase more spare parts than comparable customers in Europe or South America, which he attributes to poor maintenance and poorly trained and/or poorly utilized technicians.

Why would such a well-managed and successful firm with a solid market niche subscribe to TekNord? Two years ago when the agreement was signed, the company was undergoing an expansion and modernization effort that involved a general reorganization, and the owners felt they lacked appropriate expertise and experience for introducing new information technologies. TekNord's manager, who reported directly to the client firm's general manager, provided that expert advice. Once the initial consultation was complete and he had proved its value, his continuing advice was sought concerning improvements in production planning and the installment of new computerized inventory systems.

The TekNord manager's relationship to other firms also proved useful to Roblon. For example, among his clients were two of Roblon's subcontractors, and through his efforts all three firms began to coordinate

quality control matters. Another client of the Teknord manager who produced net bags, had trouble with its take-up spools for the twine it used. He used his knowledge of Roblon's capabilities to bring them together and help design a new machine, which Roblon produced and is now about to market.

Some of the company's relationships with subcontractors seemed to match the goals of the new Danish networking programs. The Teknord manager, however, had not applied for any assistance as an official Danish network broker. He was considering making application, however, to work with two other firms that make nets and trawls for fishing boats and with the Fisheries Testing Institute, a laboratory capable of testing performance of the products under varying water conditions. Unfortunately, the NordTek manager had just resigned after nearly two years with the firm. When asked whether the business would seek a replacement, the general manager replied emphatically "yes." He would like to find someone who could help design a total quality control system.

With the major concern of Roblon's management not losing market share but saturating its market, expansion into eastern Europe became a possible solution. The substantial quality and long life of the product force the company to be alert to developing and pursuing new market opportunities. Therefore, the company is always looking for new products. The newest product opportunity on the horizon is cable for the telecommunications industry. The company has already built and demonstrated on a prototype for a trade show in Germany. Time will tell whether or not this team will be able to use the skills developed working on their current product to compete in tighter, less familiar markets.

**The Industrial Center at Farsø:** One of the earliest NordTek initiatives was a center to support some 40 furniture firms concentrated around the town of Farsø, a small city of about 5,000 people located in the southern part of the county, about 50 kilometers from Aalborg. The problem that stimulated the proposal for European Community funds for this center was the conviction of local officials that the furniture firms were not competing successfully in foreign markets. In 1986, local business organizations, officials, and the industrial council developed the idea of a state-of-the-art center to help the firms learn about more advanced production and design techniques, train employees, and provide market information. The center is frequently cited in the United States as a model program. Yet despite an investment of more than \$3 million in a very attractive and seemingly functional facility, the center has not been successful. What happened and

why has it failed to meet designers' expectations? The newly hired director was quite willing to share his opinions.

For one thing, the new part-time director admitted, a disproportionate share of resources were absorbed by operations, maintenance, and management. The governing and managing body was top-heavy, with nine highly paid directors but few skilled employees to operate and maintain equipment, and nobody involved in the planning process had enough experience in the wood products industry to properly design the factory. Though equipped with the most advanced machines, there was insufficient space for the level of inventory needed for production. Machines were accepted without preliminary testing, and consequently some have never functioned properly. For example, one machine valued at \$500,000 has never worked, and no one seems to be able to repair it. A finishing robot is incompatible with other equipment and thus cannot be integrated into any sort of flexible manufacturing system. Further, and perhaps most importantly, local firms were not involved sufficiently in advance to determine and address their specific needs, and they have virtually ignored the center.

By 1990, the original staff had left the Center, but local government officials, in one last-ditch effort to make a success of the Center, raised \$450,000 (one-third comes from NordTek and one-third from local funds) and hired a half-time director to try to restructure the Center into something useful for the industry. The new director is reorganizing the Center with a much leaner and flatter organization, seeking skilled craftsmen to work in the shop, and calling on firms to find out what they want and try to regain their confidence. But to expand the market for services, he also would like the agency to evolve into a national center. The director intends to eliminate non-functioning equipment and establish product centers around the equipment that is able to perform operations to enhance local production capabilities. Other services the Center will provide include teaching CAD/CAM, training on new equipment, and, with a French computer program, promoting new designs. As a trained network broker, the director also hopes to develop networks among firms using the Center. His plans were to be assessed in October 1990, and at that time the officials would either give the new staff the authority to proceed with their plans or close the Center. The new director is confident he can turn the Center around, but he is not sure he can do it in the few months he has before a decision must be made.<sup>2</sup>

These three local technology centers are representative of the many local NordTek initiatives. One is a proven

success, one is potentially valuable but still has not completely achieved its potential, and one is still struggling to find its proper role and make its mark. To give the programs additional time to prove their worth and become self-sufficient, the county has requested an additional year of funding from the EC's regional fund. If granted, NordTek will begin only one new county-wide initiative, a Total Quality Control program (TQC). It has already been designed and will be implemented by the Institute for Production at the University of Aalborg. The objective of the new project is to completely immerse small firm owners in the total quality control effort and make this commitment a selling point of the county's manufacturing sector. The elements of the newest program are research projects focusing on quality problems of small firms; student projects that would both train students in real situations and help firms; joint venture development projects that may, for example, involve distance learning in remote sites; projects with consultants' companies that support ongoing private sector activities; and experience groups to bring TQC to the attention of larger numbers of firms.

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### **Networks: Bringing Third Italy to Denmark**

In February 1989, the Danish Minister of Industry and Trade released a "Plan of Action for Establishing Network Cooperation in Denmark." This most recent state-sponsored technology development program is loosely modeled on the flexible manufacturing networks among small firms in Emilia-Romagna but modified to fit the economic and social structure of Denmark. The Minister supported his proposal with 150 million Dkr, or about \$25 million. The premise behind the scheme was that SMEs constitute a large part of Danish trade and industry as in other countries, but that Denmark lacks the large firms that might be expected to act as the engines of growth. Thus, he concluded, it is imperative that small firms work to strengthen themselves through networks.

The key ingredients of the Minister's plan as originally conceived were challenge grants, network brokers and centers. The center carries out functions needed by a network, brokers are called upon to motivate cooperation, help establish the contacts among firms, and make the arrangements for establishing networks, and challenge grants provide firms and brokers with incentives to spur cooperation. The Jutland Technological Institute (JTI), which has now merged to become the Danish Technological Institute (DTI), was assigned responsibility for designing and overseeing implementation. The success of the resulting plan hinged largely on the abilities of the network brokers

and the acceptance of the concept by the businesses themselves.

To locate the best brokers, the Ministry of Industry and Trade cast a wide net across the nation. Qualifications were carefully specified, and JTI designed a competitive and highly selective process that would give those making the final cut high visibility and stature. After about 400 initial inquiries and 125 applications, 40 individuals were selected to participate in a nine-month training program. Each participant had to commit 25 percent of his or her time to the program and pay about \$4,500 for a program of six (later extended to seven) two-day sessions spaced about six weeks apart. Many of the final forty were already industrial or marketing consultants, but others, including TekNord managers, were also included.

To ensure that the nation's small businesses were well aware of the policies and opportunities, the JTI began a vigorous marketing campaign. The press coverage, however, was not all positive. Critics—many of whom were business associations which felt displaced and viewed linking firms as their responsibility, not the states'—also received coverage. Some of the objections were to a challenge grant program intended to stimulate new forms of collaboration and provide incentives for changing behavior. The challenge grant program was divided into three phases roughly comparable to phases of the U.S. Small Business Innovation Research Program, phase one (\$3 million) intended for the design of new forms of cooperation and requires (1) at least three firms and (2) at least two forms of cooperation, phase two (\$5 million) to develop particularly promising ideas further, and phase three (\$15 million) for a small number of the most advanced developments for full implementation. The funds were to cover part of the costs incurred by small businesses implementing experimental approaches and to help defray costs of consultants whom, it was hoped, would also revise their own thinking in support of collaborative arrangements.

The training, designed by DTI to cover various elements of network development in a sequential manner, broke down about halfway through the program. Participants, many of whom were experienced manufacturing consultants, believed that their experiences were not fully appreciated and that the level of discussions was too theoretical. Rather than conduct mathematical sectoral analyses, their first assignment, they preferred to look for potential firms to connect to one another—which, spurred by challenge grants, other untrained consultants were already doing. The second session on how to run focus groups of small firm owners was criticized as being too conceptual and not

addressing real problems of people working in groups. Following the third session, the training was redesigned with more traditional lectures and case studies on the nitty gritty of forming networks, and brokers were given free rein to go out and begin implementing newly learned strategies.

### *Networks and Collaboration*

Despite problems, inevitable when implementing new, innovative programs, and under close scrutiny by critics, the national policy appears to have been successful. By June 1990, about 2,000 firms, or more than one out of every four, was involved in some sort of recognized network activity.<sup>3</sup> Further, a recent government survey found that for every two firms in "certified" networks, one additional firm is involved in a network with other firms. Based on anecdotal evidence, officials are confident that "[networking] has spurred ingenious activities that firms would not have thought of or undertaken alone." Brokers contend that even though networks must be market-driven and sought by firms, owners do not have the time or expertise to make the arrangements and that the role of consultants is vital. As one consultant said, "the biggest threat to networks is to lose tempo. Once the ignition is there, the wagon has to move. If too much time goes by, the momentum is lost." Some typical networks are described below.

- Four furniture companies near Horning together collaborated to create a new "Hi-Tech" youth furniture line, each specializing in different pieces. The product is intended primarily for export to Belgium and Netherlands, two countries whose markets Danish firms have not successfully penetrated. The network expects to open a sales office in the Netherlands soon.
- Three small medical equipment producers working with hospitals and research agencies are developing a computerized patient data management system.
- Seven firms near Skanderborg have joined forces to design and produce an entire store display line, including mirrors, mannequins, and shelving in both steel and wood. Their target market is West Germany.
- Seven firms are collaborating on a new line of men's and women's shirts called "Airborne," based on new lifestyles and intended to be sold primarily in airport shops. Three members are apparel firms, one a design company, one in public relations, and two design and build shops.
- A network of seven companies in the fisheries industry near Fredrikshavn is working to produce fishing equipment for Soviet and Latin American markets, difficult markets for individual small firms. Members include seven manufacturers: a producer of electronic bridge equipment, a metals firm, a producer of fishing gear, a food processor, and a shipyard. In addition, a bank and the North Sea Research Center are part of the network. Together the network has created a holding company and hired a consultant expert in marketing exports to the U.S.S.R.
- Another network is being formed among firms connected to the fisheries industry to produce and market health products from the sea, such as fish oil. The group includes fishermen, processing companies, and a hospital in Aalborg.
- Ten building and construction firms that concentrated in landscape gardening took note of the influx of Swedish golfers to Denmark, and decided to jointly specialize in golf course design and export that expertise. There are no other European firms in this market niche. They jointly toured U.S. courses, cooperatively purchased heavy equipment, and obtained a contract for five courses in Sweden and three in Poland, with an option for 12 more. Their newest project is to transfer European cemetery technology and design, which they believe is more advanced and aesthetically pleasing than in the U.S., to the American market.
- Tele-Punkt is a network of repair shops for appliances and telecommunications devices in 23 small cities throughout Denmark. Though not manufacturers, after learning about the network program these shops decided to join together to share marketing costs, introduce quality control ideas, and seek new markets. As a network, they were able to obtain a contract as agent for the best-selling modular phone in Denmark that individually they could not have obtained. On June 15, the network purchased a full-page ad in Denmark's leading financial newspaper with the headline "We cover the country but we're local."

The concept of networking has captured the attention of the nation. Firms have moved into new forms of working arrangements—often with the help of or at the suggestion of private consultants and trained network brokers. TekNord, for example, was in place prior to the start of the formal program and thus was ineligible for new grants. But the TekNord concept itself is networking, with groups of firms sharing the

cost of expertise each could not afford alone. The TekNord managers view themselves as “midwives” of the networking process and receive considerable publicity if not funding. During three years of TekNord’s existence, its agents have entered into networks with 40 SMEs. Most relationships forged in Denmark are targeted at some form of product or process development or utilization or at new markets. Shared services were of less interest, very likely because those needs were already being largely served by existing cooperatives, trade associations, and unions.

There is little doubt that challenge grants have been instrumental in stimulating collaboration, but now that both the training program and first phase of the challenge grant program have ended (although Phase Two and Three funding opportunities are available), Denmark will be able to determine just how deeply networking has been internalized by firm owners as an effective mode of business operation as well as a strategy for approaching new market opportunities. Or might it simply have been an opportunity to receive government funds at a time when many other programs were ending? Officials at the DTI contend that networking has proven itself as an industrial development strategy and will continue on its own merit, and network brokers second that view. Now that firms have seen and experienced the benefits, a network broker commented, they will continue to seek partners and rely on consultants to make arrangements and provide advice. Although the government has no plans to repeat the network broker selection and training program, DTI is planning a training program for the staff of the 15 Technology Information Centers to reinforce the network approach among firms. A government-sponsored evaluation, now in progress, ought to shed additional light on the program.

A third observation is that networking was also introduced to enhance the strength of Danish industries in world markets. While the notion of collaboration is intrinsically desirable, there is also an expectation that some networks will eventually lead to mergers, resulting in larger firms that can better compete internationally. Selected instances of vertical integration are not at all incompatible with the goals of networking to strengthen SMEs. Small is beautiful, but medium-size may be more competitive.

Last, networking in Denmark has not yet led to any strong industrial hubs or districts such as have developed in northern Italy. If a hub does develop, it will most likely be around Århus, which is not rural but where a number of firms are working with DTI to develop a market niche manufacturing equipment for the handicapped. Two networks have been formed

that are monitoring world markets, sharing the costs of design engineers, or establishing quality standards.

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### **Djursland: Building a New Rural Economy**

The newest partnership between the government and European Community to enhance rural development is underway through the Danish Technological Institute in Djursland, the northeastern corner of Århus county. This area along the eastern coast of Jutland is rural, depressed, and suffers all of the characteristics of depressed American communities—high unemployment, low educational levels, and outmigration of youth. The eight municipalities that comprise Djursland, the largest of which is Grenå (18,000 residents), are located 40 to 60 kilometers from Århus. Despite the fact that the airport serving Århus is located there, the roads are usually only two lanes wide, and very little development has occurred around the airport.

Djursland only recently industrialized at all, beginning with cottage industries. Of the 850 manufacturing and construction establishments, only 11 percent have more than five employees. About half are construction and nearly half of the manufacturing firms are metalworking—blacksmiths, locksmiths, repair shops, and small machine shops. The few large firms are in textiles and furniture. The coast does attract tourists, and a modest tourism industry has developed. Unemployment rates in towns, however, range from 11 percent to 17 percent. Three vocational schools, a technical school, a commercial school and a school for unskilled workers (AMU), serve the area, but these programs are believed to be irrelevant to local needs. Most of the manufacturing work force are the first generation off the farm, and relatively poorly educated and trained for their occupations.

This area is about to become a testing ground for rural development policy. The City of Århus and the European Community together invested about \$2.4 million into a project to demonstrate that a technology-based plan can revitalize a rural economy. The development plan, devised by experts at DTI working with the Århus Technical College and local officials, keys its success to the vocational institutions and a new information system. The goal is to create an infrastructure to support new business growth and encourage modernization of existing firms. In the plan, schools will become brokers between the SMEs and DTI and consultants will provide technical expertise. The lead planner at DTI describes the technical infrastructure as a “virtual educational institution” that links SMEs through schools to the latest process technologies,

including the initial elements of computer-integrated manufacturing (CIM), resources, and educational opportunities. Networks also will play a role. The long-term objective is to strengthen firms through networks, including linking firms interested in moving toward CIM to share experiences and development expenses and to seek new markets.

If all goes well, planners expect a 33 percent increase in employment within two years, which seems to be very ambitious, given the current skill levels and degree of technology adoption among local firms and the experience of schools. Not having an opportunity to talk with local officials or visit the schools, however, their views toward the project are unknown. All information came from analysts formulating the plans. Part of their optimism is based on Djursland's potential for new development if the area is suitably prepared. For example, the harbor at Grenå is well situated and could become a major trade center. There is a good commercial airport, as well as attractive recreational communities. If the project shows progress, it could prove to be an interesting case study for future analysis.

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### Lessons from Denmark

The experiences of Denmark are in many ways more useful to the rural United States than those of northern Italy. The nation is much nearer the scale of a typical American state and does not have the historical conditions that led to Italy's industrial districts. Yet Denmark is attempting to use technology, innovation, and networking to spur industrial growth. The early response of SMEs to networking in Denmark ought to temper some concerns of U.S. policymakers, and the success and failures with technology centers and government program should provide useful experiences for states.

Lacking any "industrial locomotives," Denmark has accepted technology as the key to growth. Two approaches are used to stimulate competitive advantage of Denmark's industries: wide access to information and services and promotion of networking and collaboration among firms aimed at economies of scale and potentially mergers into larger size enterprises.

To diffuse technology widely among small cities and villages, the government over the past decade has implemented what may be the most extensive system for providing information and services of any European nation. In fact, many believe that more services are provided than can be supported by the existing and potential industrial base—and, in fact, more than

can currently be supported by the overextended tax revenue base. Eagerness to modernize and become a major player in the European market and gain access to European Community funds led to a proliferation of state-initiated, technology-based programs and services in the 1980s. Some responded to existing needs and addressed real opportunities, and some were speculative, hoping to generate new opportunities. Using government policies and subsidies as Denmark does, some failure may be unavoidable. Subsidies are used to stimulate innovative activities, to change behavior, and to absorb some of the risk—not to support activities that would have occurred even in the absence of the funds. Thus, everything cannot be expected to result in success.

The provision of information through local agencies called Technology Information Centers (TIC) is perhaps the most interesting to rural America because it resembles in its design the familiar Cooperative Extension Service. County-based TIC officials maintain close ties to local firms, providing them with information on which to base capital investments or market decisions and helping to match them to sources of expertise. This is a free service, as it is in the U.S., and appears to be successful.

Assessing the value of providers of direct services is difficult. Each of the various providers is trying to prove its worth by shifting financial support from government to customer. The Danish Technological Institute is the most successful; only 10 percent of its revenue comes from the state. ATVs or "know-how" centers, however, are not yet so successful. There undoubtedly will be a weeding out of the least successful programs followed by mergers to strengthen the remaining ATVs. Denmark is small enough so that accessibility ought not to be a barrier for small communities.

The eighty-plus local centers may represent the most interesting economic development policy for rural areas. Can centers that provide technological services become active catalysts for growth? The answer lies in how carefully they are designed to meet local needs, how actively the community is involved, and how effective the leadership is. Based on very early signals, prospects for centers that were established largely to take advantage of funding opportunities are dim. Of the existing local technology service centers in Denmark, 27 are financed by the European Community, and only four are more than six years old. Thirteen were started this year alone. Initial assessments are showing mixed results. Some centers are already expected to fail once the initial government funding is exhausted and are forced to confront the market for

survival. Other centers, however, show promise and may be expected to fuel growth both by providing community focus and pride and by providing needed services. To date, the most successful centers have been those with a sectoral focus and least dependent on outside funding.

The other, even newer policy of the Danish government is support for flexible manufacturing networks. Even though the concept of cooperation is not new, it has been primarily confined to shared services. The state introduced flexible manufacturing networks to complement traditional cooperatives in an effort to stimulate increased collaboration in product design and development, market penetration, and production. This concept was announced with a great deal of fanfare in order to generate interest among firms and consultants, and it was initially met with some resistance. However, as successes mounted and firms showed more interest—in both access to funds and new ideas—criticism subsided. The Danish approach was very similar to approaches of some American states—a program to identify and train experts to help firms enter into collaborative arrangements coupled with challenge grants to stimulate new behavior among firms until the impacts of changed behavior could be shown. At first blush, it appears to have been successful, and many Danish firms are participating. The true test, however, will come after the challenge grants are no longer available.



## What Lessons Do Italy & Denmark Hold for Less Populated Areas of the United States?

**E**conomic development strategies for small cities in Italy and Denmark and in the United States are remarkably different. Small Italian and Danish cities support policies that make firms more competitive while cities in the United States support policies to compete for firms. This oversimplification describes the different ways development is perceived. Danish regions would like to attract Swedish or German firms, but that is not where they direct development efforts. Indeed, laws restrict regions or counties within countries from competing with one another for plants. In contrast, in the United States development efforts concentrate heavily on recruitment. Support for existing industries generally comes only after expansion plans and a minimum number of new jobs are announced, and support for business startup goes predominantly to service industries, not production firms. Together, these state initiatives do little to help firms achieve a comparative advantage in their markets so they are able to prosper and grow.

The situation is different in Italy and Denmark, where government at all levels appear to fully understand that competitive advantage of regions is achieved through competitive advantage of industries. There, development policies are designed and implemented to help make firms more competitive in global markets.

Although the environment in Europe is influenced by national policies, regional and local circumstances dictate how policies translate into productivity increases and shape local economies. There is, in both Italy and Denmark, distinctive community cohesiveness, homogeneity, and stability. Each firm visited was owned and managed locally, and much of the investment capital originated in the community, with savings-minded merchants and from farmers willing to abandon their agrarian heritage for a new industrial way of life because the community was their point of reference, not the land or farm.

The sources of competitive advantage in Europe are product and process innovation, quality, and differentiation. In the two regions examined, a set of common factors shapes the environment and creates a support system in which firms can achieve competitive advantage. It includes:

- business and personal relationships;
- ease of information flow;

- access to services and consultancies;
- fusing of market development, design, and technology; and
- public policies.

**Business and Personal Relationships:** Working relationships among firms represent the greatest advantage of small cities in Italy and Denmark. These relationships provide opportunities for innovation by expanding available technological know-how. As observed in the ceramics district, firms that produce equipment are considered extensions of technical staffs of firms. Relationships with customers provide access to the outside world and information about potential markets. These relationships provide opportunities for greater cost-effectiveness through shared services.

Tight personal relationships within industrial districts also cause rapid diffusion of innovation among firms, creating a need to constantly innovate to stay ahead of one's local competitors. The agglomeration of firms represents a collective economic power that turns small firms into major players in world markets. Although these carefully nurtured networks might prove difficult to replicate, closer relationships among American firms could provide economies of scale, greater leverage with suppliers, greater market impact and spur innovation.

**Ease of Information Flow:** In a modern economy, access to information is vital. Small cities in Denmark and Italy have taken steps to make sure that information flows freely and effectively. The relationships described are but one way that information flows—by word of mouth, through trade association meetings and at social functions. But it is also important to have access to the outside world, and for this telecommunications systems are vital. For example, in Denmark, 15 Technology Information Centers locate resources to solve business problems; in Aalborg, a toll-free number brings information about European Community funding opportunities; and in the Emilia-Romagna city of Carpi, a service center provides the latest fashion information from around the world to more than 2,000 small knitwear firms. Information is considered so important to growth that the European Commission's Science & Technology Directorate allocates 40 percent of its budget to information technologies, and Denmark's National Agency of Technology recently awarded matching grants to 16 local information

technology centers. Such information-access programs could be implemented in less-populated region of the United States, if it were made a priority and if people were educated to make use of the information.

**Services and Consultancies:** To ensure that information is used effectively and innovation is fully supported, technical advice is made available to SMEs. Service centers in Italy and technical institutes in Denmark provide an array of services to help firms develop and improve the quality of products and processes and to lower costs. Subsidies provided to encourage innovation and research are expected to be repaid if the venture proves commercially successful. The major distinction between U.S. and European programs is that European programs are generally designed for small firms, not multinational corporations. Consultants and officials there are particularly adept at listening and responding to needs of small firms. U.S. programs, which are measured by numbers of employees served or jobs created, tend to be reluctant to work with SMEs, in part because accountability is difficult to document when desired results are measured in increased productivity.

**Marketing, Design, and Technology Deployment:** In Italy and Denmark, market information and design are considered a vital part of technology deployment, and often combined in a single agency or center. The market drives needs to innovate and modernize. Thus, for example, a single service center in Castel Goffredo offers fashion design, market information and high-tech testing, and the Danish Technological Institute and Technology Information Centers provide as much assistance with market development as with technology development. In most states in the U.S., separate agencies deal with marketing and technology, and no agency addresses design.

**Public Policies:** Though local development occurs in Italy and Denmark through competitive advantage of firms, the public sector takes an active role. Industrial policy is not avoided but considered a legitimate role for government. When Emilia-Romagna was established as a region, its government immediately set upon a three-phase program that began with planning, supported business expansion and modernization for about ten years, and then shifted emphasis to programs intended to enhance product quality and expand opportunities for disadvantaged populations. The Danish government has provided a steady stream of strategies that have supported innovation, modernization, and market development. All are aimed at altering behaviors of businesses and sharing risks. Governments assist firms in taking their first steps, but once they learn to walk, firms are on their own. Some

U.S. programs, such as incubators, seed capital, and small business innovation research programs, are designed to encourage risk-taking. Yet more U.S. dollars are spent on resources that very likely would have been provided by the companies in the absence of subsidies—customized training, capital from industrial revenue bonds, facilities—not to enhance firms' competitive advantage.

**Education and Skills:** One item not mentioned as a factor in competitive advantage in Europe is education and training. Yet skills and knowledge are important to competitive advantage. It is only perceived as less of a factor in Europe than in the United States because it is less of a problem. Educational levels are on average higher, and pools of chronically unemployed are much smaller than in the United States. There is an unskilled work force—mainly female—but many training programs are available and most provide costs-of-living stipends. There was another reason for seeming lack of concern; the organization of work in many of the largest companies visited was not particularly progressive. Management in mid-sized companies did not expect its operators to be innovative, and if anything, automation in mass production industries, e.g., ceramic tiles and hosiery, has led to a bifurcated labor force with lower skill needs among operators and greater skill needs among technicians. The situation was reversed in the engineering firms, where skill needs have become much higher, but technical institutes and apprenticeship programs are able to turn out a sufficient number of technically training workers. The situation in Århus, where almost two-thirds of the 12,000 unemployed workers have the equivalent of a masters' degree, is perhaps an extreme case, but it does point out the availability of skills and knowledge from which industry can draw.

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### Toward a Modern Rural Industrial Policy

Even though Italian and Danish experiences with rural technology-based development are tied to the two nations' cultures and traditions, economic profiles, and political systems, each example possesses certain elements that can be useful in many industrialized (and industrializing) less populated regions. In fact their characteristics are not as foreign to U.S. economies as it might seem. About 60 percent of all manufacturing firms, for example, are independent and locally owned; there is a revival of small town and community spirit and desire for increased stability; and agricultural policy is increasingly linked to rural development.

The *first*, and perhaps most basic, revision of rural development policy is to shift emphasis away from localities competing with neighboring communities and states to an approach that aims at making local firms more competitive. Competitive firms produce competitive localities and nations. This simple shift in emphasis in economic development represents the very underpinning of European successes. It broadens the focus of policy from recruitment to innovation and building "inner strength." The key lies in accepting the importance of modernization to economic growth.

*Second*, government programs should be brokers and catalysts, not props and crutches. Government funds should be used to encourage the most innovative and promising private decisions. One approach is that used in Denmark, where local communities have been given opportunities to apply for grants for activities likely to lead to technological progress. Implicit in this is the need to acknowledge the possibility of failure as well as relish the successes. In both nations, incentives were viewed as phases of long-term, planned modernization programs.

*Third*, governments can supply information needed to make good decisions. That emphasis has been acknowledged and accepted in the U.S. at all levels of government for agriculture since the end of the 19th century. Industry, which has many of the same needs for information, has never had the same level of public support. This need for quality information extends all the way from laboratories doing research to firms making decisions about what technology to use and how effectively to implement it.

*Fourth*, governments can be catalysts for innovations and agents for changes that involve more than one firm. It can stimulate new and innovative behaviors among firms, such as the alliances and collaborative networks that the Italian government promoted in the late 1970s through the early 1980s and as the Danish government has been promoting since 1989. At the present level of public funding for economic development in the United States, states and local programs are not of a scale to make a difference. As the U.S. Congress' Office of Technology Assessment learned, only two percent of American SMEs are being reached by existing technology extension services. Only through group services and fostering of networks, can the public sector spur new development.

*Fifth*, functional programs and policies should be combined in single agencies or well-coordinated and, where appropriate, sector-specific. The most important aspect of European programs—rarely found in the United States—is the linking of programs addressing

marketing, design, and technology. In most states, technology and marketing are supported by different agencies, and design is rarely considered at all. Programs and centers that provide services to firms in Denmark, and particularly in Italy, consider all three to be essential components of competitiveness. Italian colleges of engineering are noted for including aesthetics and design courses in their curricula. Design schools in the U.S., many of which are world-renown, are separate from engineering and business.

*Sixth*, as strongly emphasized by Michael Porter in *The Competitive Advantage of Nations*, rural or regional development must identify strengths and build on clusters, not import random or diverse plants or services. The clusters require magnets such as colleges or centers for services or special infrastructure, but only through clusters will developing and self-sustaining growth take place. For many years, growth theory argued for economic diversification, even in rural areas. This avoids the impact of single industry downturns but also misses out on opportunities to build any real industrial strength.

*Seventh*, but perhaps most important, governments are responsible for human resource development. Public education from kindergarten to grade 12 is a local responsibility under state authority. How education meets the needs of the local economy, however, is up to local officials. Once again, agriculture provides a historical model for education's role in modernization. From the days of the Grange and Farmers Alliance—when the phrase "Knowledge is Power" shaped both policy and practice—to today, when Future Farmers of America alumni organize adult classes to inform farmers about new methods, education has been crucial to innovation and competitiveness.

These recommendations will no doubt have to be molded and adjusted to fit specific conditions in small cities in the United States and the needs of its firms. But the importance of innovation and technology transcends cultural differences and political boundaries.

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<sup>1</sup> By fall 1990, the 23 ATVs had been reduced to 19, with further consolidation planned.

<sup>2</sup> A decision was made to close the Center by the end of the year.

<sup>3</sup> By September 1990, the number of firms engaged in networks was estimated at more than 3,000.

# Appendix A

## Interviews Conducted

### *Emilia-Romagna*

Oscar Grenzi, Segretario, Confederation Nazionale dell'Artigianato (CNA)  
Viliam Righi, President, CNA  
Mauro Ronchetti, Regional Secretary- Metals Firms  
Isella Malavasi, President, ikebana studio d'arte  
Giacarlo Modanski, Manager, Centro Intercomunale Formazione Professionale  
Mizko Bruschi, Dedalo  
Egidio Pagini, Mayor of Fiorano  
Dott. Mauro Prodi, Director of Finance, System  
Dott. Simona Grandi, Public Relations, System  
Prof. Ing. Giorgio Timellini, Centro Ceramico, University of Bologna  
Gabriele Canotti, Direttore General, Ceramiche Marazzi  
Dr. Rita Prodi, Assopiastrelle  
Maura Franchi, Regional Government  
Dott. Eduardo Terenziani, Administrator, SOPRIP, Province of Parma  
Cristina Bertelli, Regional Government  
Mario Pezzini, Economist, Nomisma

### *Lombardia*

Giocarlo Leoni, Mantova Provincial Government  
Paolo Poletti, CITE, now PhD student  
Dott. Michele Mura, President  
Dott. Antonio Salan, Director, Centro Servizi Calza (CSC), Castel Goffredo  
Dott. Ivano Ghisini, Director, Cassa Rurale Ed Artigiana di Castel Gofeddo  
Dott. Antonio Salan, Director, CSC  
Dott. Michele Mura, Managing Director, MURA  
Claudio Pacchini, Managing Director, Levante  
Dott. Salavatore Baroni, Reg Sec., CGIL (labor union) Confederazione Generale Italiano Dell' Lavoro  
Margherita Russo, Economist, University of Modena

### *Commission of European Communities (EC), Eureka*

Peter Johnson, EC/ORA  
Hugh Logue, EC/STRIDE  
Florence Gerard, EC/PETRA  
Hanne Shapiro, EC/COMETT  
Olaf Meyer, Head of Eureka Secretariat

### *Denmark*

Jorgen Rasmussen, University of Aalborg  
Eigil Carner Nielsen, Aalborg city government  
Marianne Toftegaard Poulsen, EC Representative  
Steen Kristensen, Aalborg Technical School  
Jorgen Basballe, Director, Farsø Business Development Center, Network Broker  
Svend J. Nielsen, Director, Hadsund Educational Center  
Knud Kurtzman, General Manager, Roblon Engineering, Sæby  
Torben Jul Jensen, NordTek/Univ. of Aalborg  
Sten Sverdrup-Jensen, Consultant, T.Bak.Jenson A/S  
Niels Chr. Nielsen, Director of Corporate Planning, Danish Technological Institute (DTI)  
Finn Grønbæk, CIM Center, Århus Technical College  
Mette Ringsted, DTI  
John Orsted Nielsen, Director, Jyffos Papir  
Bibi Engleholm, DTI  
Jorgen Jorgensen, DTI Networking Project  
John Moeslund, Djursland Project, DTI  
Dorit Larsen, President, DL Consult, Network Broker, Skanderborg  
Olaf Rieper, Local Governm. nt Research Institute  
Poul Knudsen, National Project Coordinator, Eureka, National Agency of Industry and Trade  
Kurt Hansen, Technology Promotion, National Agency of Industry and Trade  
Jane Wickmann, DTI, Director, Innovation Program  
Lars Gelsing, Institute for Production, University of Aalborg

## Appendix B

### Resources

#### Italy

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