Manufacturing Networks:

For the Competitiveness of Alberta Manufacturing Industries

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Forewords

The Western Centre for Economic Research at the University of Alberta is to be congratulated for bringing this important message to Alberta. This unit of the University has had the foresight to investigate and demystify many of the economic development or manufacturing "networks" operating in the world.

Since the word 'network' has many meanings, it is often hard to discuss the subject in a meaningful way. Care must be taken in not oversimplifying this subject or in hastily selecting an inappropriate network structure. A common understanding of network types, characteristics, and critical success factors will lead to greater progress in determining benefits from their application.

Both government and industry would be well rewarded in spending the time to read this document. The concepts elicited here can be very useful in designing an Alberta model.

George Thorpe, P.Eng
Manager, Alberta Manufacturing Network
Alberta Research Council

Mr. Cameron's paper underscores the hidden potential of Alberta's manufacturing sector through an insightful study of successful networking models found in the European Community. The international movement towards cooperative alliances and the increased importance of research and investment in new technologies should give ample incentive to Alberta's private sector to work cooperatively. These network opportunities, if pursued, will assist in the development of economic opportunities on which long-term prosperity depends.

Michael Birdsell, President
Alberta Chamber of Commerce

All recognize the integral role that smaller business enterprises will play in the longer run health and development of the regional economy. The Western Centre for Economic Research therefore decided to provide as a public service this synthesis of current knowledge and thinking about the potential role that networks can play in enhancing the international competitiveness of the small business sector of our economy.

We believe readers will agree that Kevin Cameron has done an excellent job in assembling a vast amount of material and presenting it most effectively.

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Author's Note

Readers who would like to discuss this paper are invited to phone the author directly at (403)433-8418.

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Executive Summary

This study examines Alberta's value-added small- and medium-sized manufacturers, explores several prototypes of small-company networking in other countries with thriving manufacturing sectors, and assesses their potential applicability to Alberta. It concludes that both the private and public sectors must learn to operate in new ways if we are to gain competitiveness through the use of networking.

Alberta Manufacturers and the New Competitive Environment

Alberta faces a great need to increase the competitiveness of the small- and medium-sized enterprises (SMEs) operating in its higher value-added manufacturing industries (SMEs are defined as companies with less than 250 employees). Alberta's higher value-added manufacturers ship only a very small percentage of Alberta's total production and exports. With developing countries intensifying competition in commodity-grade products, Alberta will be unlikely to sustain its standard of living unless it diversifies to higher value-added products.

"Small firms able to innovate rapidly and produce efficiently in small batches can do very well in global markets."

In the value-added marketplace, Alberta has few large manufacturers (greater than 250 employees) and even more significantly, fewer medium-sized manufacturers (50 to 250 employees) than other developed economies. Therefore, the growth of our manufacturing base will depend upon increasing the competitiveness of the existing small manufacturers that surround and support Alberta's energy, agriculture and forestry sectors and that define our new research-intensive sectors (for example, telecommunications, biotechnology). Growth will also depend upon encouraging the establishment of new ventures that complement the strengths of existing manufacturers.

Today's global trading environment is a very difficult one for small manufacturers. The difficulty stems from heightened competition from both advanced and developing economies; increased demands for quality, service, responsiveness and value; fragmenting niche markets; and accelerated technological change.

In many ways, this new environment is well suited to small companies. Customer intimacy, speed and flexibility are the hallmarks of successful small businesses. The newest advances in flexible production technology and management practices can put small producers on a competitive cost footing with larger manufacturers formerly dominant due to economies of scale. In a world of fragmented niche markets, small firms able to innovate rapidly and produce efficiently in small batches can do very well in global markets.

However, the advantages of small business are balanced by important constraints that limit their ability to upgrade their products and processes and penetrate global markets. These include limited ability to:

- access professional services such as engineering, management consulting, accounting, market research and worker training programs;
- upgrade production capabilities, which might require investment in expensive new process technology;
- acquire intelligence on global markets;
- establish a credible presence in overseas markets;
- conduct extensive Research and Development;
- access adequate financing for investment; and
- fulfill larger contracts requiring large volume production capacity or multiple skills.

Both small businesses and governments should concern themselves with conquering the constraints. However the primary onus is with the private sector. The orientation and strategies of individual firms will ultimately determine whether they become globally competitive or not.

Governments can assist firms in pursuing appropriate innovative, global niche strategies. Success requires a shift from the currently fragmented assortment of business assistance programs to a more "demand-driven" approach. Private-public partnerships must be established to tailor services to the needs of SME manufacturers. Active leadership should come from manufacturers acting through strong industry associations with a clear competitiveness agenda.

Flexible Manufacturing Networks

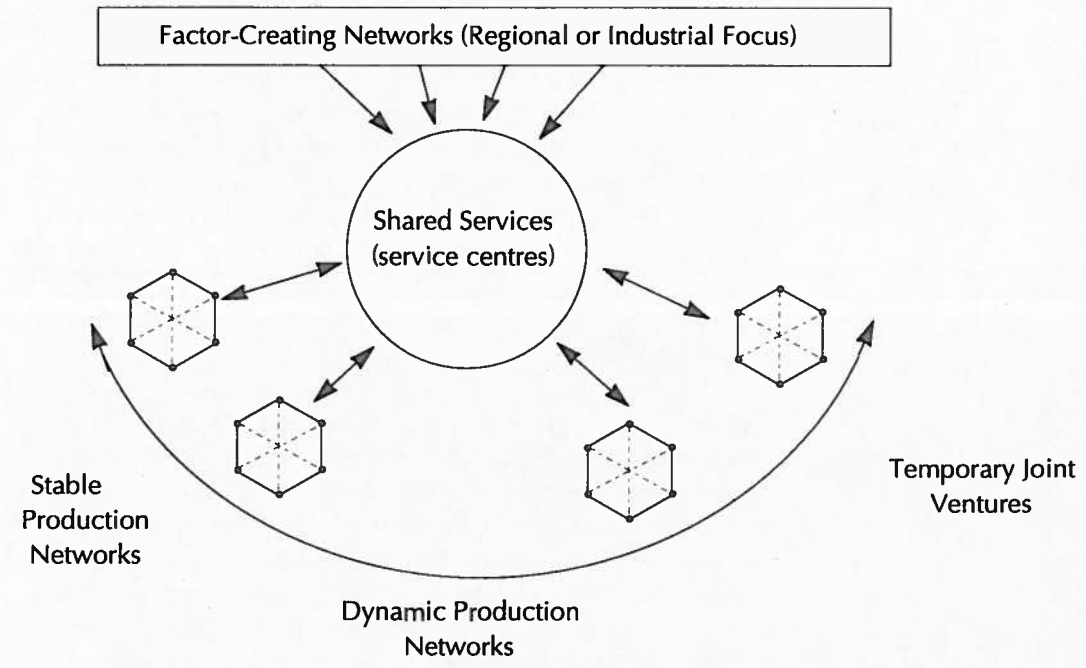
Small firms face large obstacles in pursuing global niche strategies alone. Based on the successes of certain SME manufacturing sectors in Italy, Germany, Denmark and the United States, the term flexible manufacturing networks has recently gained recognition as a new competitive model for small manufacturing firms.

From an extensive review of flexible manufacturing networks in these countries, it is apparent that the term is an umbrella expression that encompasses many forms of cooperation. Clearing the confusion requires making several critical distinctions.

The most important distinction is between factor-creating and production networks. Factor-creating networks are groups of firms that serve members by:

"Gathering international market and benchmarking information may be one of the more important activities that networks should carry out."

Figure 1. Distinctions in Networking



- putting together training and apprenticeship programs, and operating training centres;
- investigating, promoting and even housing collective investments in process technology;
- sponsoring university (and research institute) research;
- working to promote quality practices and certification in the industry;
- collecting up-to-date, industry-specific information on international markets and competitors, performance benchmarks, technological and market trends, and
- organizing trade fairs and other broad industry marketing activities;
- facilitating social interaction and information-sharing among members (which may set the stage for greater collaboration).

Though not usually considered a "factor of production", gathering international market and benchmarking information may be one of the more important activities that networks should carry out. International industry information has a special role to play in motivating small firms to pursue world-class competitiveness and effective strategies.

In Europe, factor-creating networks are usually broad-based groups organized by industry or region (or a combination of both). They include trade associations, chambers of commerce and other similar groups. Their orientation is generally far different from their counterpart organizations in North America. They work very closely with public institutions to carry out their mission, and in many cases provide services typically administered by government economic development agencies on this side of the ocean.

"Italy's dynamic networks are fluid groups of specialized firms who come together in ever-changing patterns according to the changing needs of the marketplace..."

In contrast, production networks are usually smaller groupings of firms that build on a strong factor base and work together over time in the following ways:

a) by transforming existing supplier-customer links into partnerships designed to coordinate scheduling, product development, and process improvement efforts;
b) by combining individual specialties in order to jointly develop new products, complete product lines, or turnkey projects;
c) by penetrating distant new markets through joint marketing efforts.

Each production network has its own character. A close examination of production networks reveals that successful ones show two common characteristics. First, they are invariably built upon an existing base of sophisticated "factor-creating" networking. Small manufacturers without effective, broad-based factor-creating mechanisms underpinning their efforts will not be successful in joint production and marketing unless they direct a considerable amount of energy toward the basic competitiveness-building work and trust-building. Secondly, successful production networks preserve a delicate balance between competition and cooperation.

Several strategies are used to balance competition with cooperative work. In understanding the strategies, it helps to distinguish between "static" or "stable" networks and "dynamic" networks. Stable networks are those with relatively unchanging memberships over time. They can be very competitive if members avoid over-dependence on them and maintain their efforts in other markets.

The most competitive model however, comes from Italy's "dynamic" networks. Italy's networks are fluid groups of specialized firms who come together in ever-changing patterns according to the changing needs of the marketplace. Competitiveness lies in their "hyper-flexibility" in rapidly changing markets.

Building Networks

For those interested in promoting and developing networks in Alberta, it is important to confront several common obstacles to cooperation between firms and remain alert to several apparent keys to success. The obstacles are largely cultural; defeating them requires helping firms re-examine existing strategies and business norms. The cultural obstacles that must be creatively addressed include:

- feeling that there is "too little money, too little time" to be involved in networking efforts,
- not seeing the imperative of improved competitiveness until threatening trends become obvious and are about to overwhelm a business,
- the belief that "my competitor is my enemy",
- adversarial buyer-seller relationships,
- fear of losing control of a business.

Discussion designed to overcome these obstacles is in large part what this paper is designed to stimulate.

"Without access to continuously upgraded factors of production, neither individual firms nor networks will be internationally competitive."

A Network Agenda for Alberta

European and American experience indicates the following lessons for Alberta:

1. Put networking in its proper context. The goal is small company competitiveness and modernization — small companies engaged in long-term upgrading and focused on international opportunities and competition. In this context, factor creation is the most fundamental and important target for networking efforts. Production networks have a strong role to play in market penetration and mutual learning between companies, but without access to continuously upgraded factors of production, neither individual firms nor networks will be internationally competitive.
2. Collective private sector organizations must take a leading role in shaping the specialized infrastructure really needed by small firms. This will only happen if, within industry groups (and for those working with industry groups), consensus is built around a competitiveness agenda. Current North American chambers of commerce and trade associations generally see their roles as regulation fighters and lobbyists, in striking contrast to European counterparts who see their main role as making sure members have the information, resources and motivation to be competitive players in global markets.
3. Industry groups and government should work together toward the establishment of service centres (or hubs) in a process of constant feedback and tailoring to local needs. Hubs are a critical part of "demand-driven" development policies. The Alberta Manufacturing Network (AMNet) is involved in an exciting effort to establish these hubs in line with the principles articulated in this study.
4. Service hubs can also serve as a basis for production networking. The Italian example shows that production networks can arise organically if hubs are in place and widely used by small firms. Well-run service hubs set small firms' sights squarely on global standards and opportunities, and joint activities (training, expert seminars, etc.) facilitate face-to-face interaction among SME owners and workers.

"Hubs are a critical part of 'demand-driven' development policies."

5. An important precursor to effective networking is face-to-face social interaction and trust-building among firm owners and managers. The Canadian Institute for Business Networking's (CIBN) work with networks in Ottawa-Carleton offers a useful model for how to build trust and successive levels of cooperation in an organic fashion.
6. Where production networking is not natural to a business culture, it can be stimulated by government. In the very successful Danish program, the mechanisms of publicity campaigns, "challenge grants" and trained broker/facilitators were effective in changing the behaviour of small firms. Currently, a new branch of the Canadian Manufacturers Association called Can-Net is promoting the Danish model in Ontario, and will be using this experience as a precedent for Canada-wide efforts beginning in 1994. However, the Danish experience was built on a far stronger base of factor creation than is evident in most Alberta industries; building this kind of infrastructure should be the priority in Alberta. The Danish mechanisms would be more appropriately directed if they were broadened to support the strengthening or creation of effective factor-creating networks.
7. The factor-creating networking required in Alberta implies that government development efforts should be re-structured toward a community-based, "one-window", and demand-driven (i.e. industry-led) system. This will probably require significant re-engineering of current services. Successful European experiences show that efforts to transform a business culture are not achieved by adding yet another government program to an already packed program portfolio. Transformation requires bold, focused efforts, operated with appropriate scale and concentration.
8. If production networks are undertaken, the focus should not be on static memberships or the reduction of competition and overlap in domestic industries. Stable production networks may be more conducive to building trust and establishing cooperative habits in cultures where such attitudes don't occur naturally. In the end though, production networks are not new organizational forms so much as a new way of doing business. Dynamic networking is possible once the practice of strategic cooperation becomes an entrenched way of looking at business opportunities.

"Efforts to transform a business culture are not achieved by adding yet another government program to an already packed program portfolio."

"Production networks are not new organizational forms so much as a new way of doing business."

Finally, the following next steps are recommended as a means of preparing the way for networking initiatives in Alberta:

1. The Alberta economy must be more precisely mapped in terms of SMEs in high value-added manufacturing, specifically focused on clarifying linkages and geographic clusters.
2. Related studies should be undertaken to understand the current membership boundaries, strength and orientation of industry associations and chambers of commerce serving Albertan small manufacturers.
3. Continue the current efforts to coordinate current government services to SMEs, incorporating the principles described in this work to elicit greater participation by SMEs in creating a demand-driven approach to business support services (AMNet's efforts are particularly promising and should be fully supported).
4. Study both CIBN's networking experiences and Can-Net's pilot production networks in Ontario closely, and use the knowledge gained to promote production networks in appropriate sectors of Alberta's economy (see the body of the report for descriptions of these organizations).

Section I:

Alberta Manufacturers and the New Competitive Environment

Introduction

Alberta's small- and medium-sized manufacturing enterprises (SMEs — defined here as manufacturers with less than 250 employees) are essential to the future health and diversification of our economy. This fact was recently widely recognized as Albertans publicly reexamined their economic prospects under the Toward 2000 Together Initiative. But the competition faced by Alberta's SME manufacturers in global markets is more demanding today than it has ever been. Meeting the demands requires intense customer-focus, continuous innovation and improvement, constant upgrading of the firm's skills, and innovative strategies to insure survival.

As one of our contributions to realizing the aims set forth in the Toward 2000 Together process, this paper will identify challenges facing small manufacturers and ways that small firms in Alberta can overcome the constraints they face through strategic cooperation. In particular, the idea of "flexible manufacturing networks" has gained recognition as a central reason for the surprising success of small companies in some regions of Europe, and as a potential strategy for making small manufacturers competitive in North America. We will take a critical look at this idea, try to define it, and assess in which ways it can be used to increase the competitiveness of Alberta's SME manufacturers. The roles of small companies, industry groups and government in small company networking will be explored.

The Importance of Small Manufacturers to Alberta

Beneath all the complex equations and theories of modern economics lies one fundamental truth — the growth of a society's wealth is determined by its productivity growth.

The manufacturing sector is on important one for raising productivity growth, especially in societies like Alberta's with small population bases. Manufactured goods are more widely traded than services. Success in international markets frees productive local industries from the constraints of the small local market, so they can expand and absorb resources from less productive industries.

In resource-intensive societies such as Alberta's, manufacturing helps build wealth and dampen economic volatility. Manufacturing industries have greater potential for generating unique products than do price-sensitive resources, and thus show less price volatility over time. As well, innovative process equipment is essential to raising productivity in the equipment-intensive resource extraction and value-added processing sectors.

The more sophisticated the manufacturing base in Alberta, the more likely it is that Albertan efforts will be rewarded with premium prices paid by international customers. Sophisticated manufacturers spend their export earnings largely at home, tending to demand and support more sophisticated (and thus more productive) component and service supplies. The net effect of their success is high wages and profits and an expanded tax base from which to fund important public programs.

Alberta's economy is resource-based and, to a large extent, we have not used this resource base as a springboard into higher value-added resource markets (fine papers, sophisticated building products, and so forth) or innovative supplier indus-

tries (resource processing machinery, for instance). Today, most of our exports are still relatively unprocessed resources. According to the Alberta government's Economic Development and Tourism Department, Alberta's export revenues in 1990 showed the following composition:

- exports totaled $17.2 billion, accounting for more than 20% of GDP;
- of the exports, services accounted for $1.53 billion and merchandise exports totaled $15.74 billion;
- of the merchandise exports, relatively unprocessed resources accounted for approximately 72% (energy, minerals, agricultural commodities and forest products) and manufactured products approximately 27.5%;
- of the manufactured exports, approximately 85% consisted of semi-processed, low-to-moderate value-added resource-based products (including processed food, petro-chemicals and newsprint); and 15% (or just 4% of total exports) consisted of higher value-added products such as machinery and electronic/electrical equipment.

There is a growing realization in Alberta that we can no longer rely on commodity-grade resource products to sustain our high standard of living. Alberta has not yet developed a strong base of world-competitive manufacturing firms. We have developed sophisticated services (oilfield services, construction, etc.), which are now an important part of our economy. And many Alberta oilfield equipment manufacturers are successfully developing international markets. But in spite of a decade of expensive government-led attempts to diversify our economy away from resource dependence, it is clear we have a long way to go.

"Just 4% of Alberta's total exports consisted of higher value-added products such as machinery and electronic/electrical equipment."

Smaller manufacturers are important for a number of reasons. Alberta's manufacturing sector is one populated with large resource-based processors at one end of the spectrum and many smaller manufacturers serving these industries at the other. Our higher value-added segments are populated largely by firms with less than 50 employees. We do not have the large, diversified, high value-added manufacturing firms seen in Ontario, the United States, Japan and Germany. More significantly, we have relatively fewer medium-sized manufacturers (50 to 250 employees) than are seen in the manufacturing sectors of other developed economies (Toward 2000 Together discussion paper, p.60).

The growth of our manufacturing base depends upon increasing the competitiveness of the existing small manufacturers that surround and support Alberta's energy, agriculture and forestry sectors and that define our new research-intensive sectors (telecommunications, biotechnology, etc.). Growth will also depend upon encouraging the establishment of new ventures that complement the strengths of existing firms in these sectors.

Achievement of international competitiveness by Alberta high value-added manufacturers must occur either through the growth of small companies into medium-sized ones or through networking alliances among small specialized companies. As we will explore later, the international marketplace is changing in ways that offer significant opportunities to small, specialized flexible manufacturing units that compete on innovation. Empowering this process in Alberta will be the key to successful diversification.

Toward 2000 Together

Recently, Albertans have been looking at these facts and their future economic options in a widespread consultative process called Toward 2000 Together. This talks, which began in May 1991, culminated in a Premier's Conference on Alberta's Economic Future (May 29, 1992) and a draft report from the Advisory Committee on Alberta's Economic Future in May 1993. Many of the recommendations arising over the course of the process seemed to be adopted in Premier Ralph Klein's New Economic Development Strategy, released in April 1993.

The *Toward 2000 Together* Initiative revealed a surprising level of consensus within Alberta about the challenges faced by our economy and the general approaches Albertans must take to meet them. In terms of future wealth creation, Albertans generally agreed:

- Alberta must build on its strengths in resource-based industries (agriculture, energy, forestry) through a "value-added approach". This means producing the sophisticated input products and services needed by resource industries (machinery, training, etc.) and producing higher value resource products (refined paper, high-grade cuts of lumber and kitchen cabinets rather than pulp, for instance).
- The government's role in supporting business must change from direct intervenor subsidizing individual companies ("picking winners"), to one which acts as a facilitator offering broadly-based strategic industry support such as infrastructure development and international marketing assistance. The market should determine which firms will emerge — the government should help create the environment to insure their growth and international competitiveness.
- Stakeholder groups and sector organizations (trade associations, unions, etc.) should take the lead in formulating value-added strategies in their sectors. Their strategies should in turn be integrated into, and act as the base for, the government's overall business support strategy.
- The delivery of direct business support should shift from the provincial government to community-based organizations that are more intimately aware of local needs.
- The complexity of dealing with the provincial government should be reduced — the government should streamline its regulatory processes and support programs to a "one-window" approach. It should try to coordinate the services it does provide in order to reduce overlap.
- Local companies should be encouraged to adopt the technology and practices necessary to insure competitiveness in world markets. They should also be encouraged to develop strategic alliances amongst themselves, with government, with local education and research institutions, and with companies overseas wherever possible.

These general recommendations are very good ones for developing the SME sector. Implementing them however is far from easy. In particular, the last recommendation is at the heart of making the other recommendations work. Yet, it is easily the trickiest to implement. How exactly does a government "encourage" firms to take on new technology and processes, or to "develop strategic alliances?" What exactly do these recommendations entail at the level of the individual firm?

In a sense, the exercise of creating an overall "economic strategy" in a private sector economy is always an intriguing one, fraught with potential for paradox, ambiguity and empty platitudes instead of concrete actions and results. The main problem is that the ultimate decision to pursue the "strategies" hoped for are in the hands of private actors — entrepreneurs more worried about their individual survival and prosperity than about their society's grander schemes.

The forces acting upon their decision-making will determine how wealth is created. Important external forces include financing constraints, difficulties in attracting and holding managerial talent and skilled labour, competitors' actions, and new demands from specific customers. Internal forces like personal hopes, dreams and prejudices, time constraints, cognitive limitations, anxiety over change and so forth may be even more important. Governments are poorly prepared to address the complexity of this decision-making dynamic and are therefore often left with general principles and no effective means of implementation.

From Supply-Push to Demand-Pull Policies

The Toward 2000 Together recommendations imply a whole new way of approaching small business development — a move away from a bureaucratic, fragmented set of separately administered programs toward an industry- or community-driven approach that helps local actors build on existing strengths. A major ingredient to making this value-added approach work is stimulating coherent demand for specialized services from industry itself, especially the small-company sector. The issue is how to move from a "supply-push" to a "demand-pull" dynamic.

"The issue is how to move from a 'supply-push' to a 'demand-pull' dynamic."

The difficulties experienced by technological extension programs are offer an example of the problems inherent in the current "supply-push" approach to economic development. Companies rarely show enough interest governments promoting new technology. The technology message is necessarily general and usually insufficient to persuade individual companies to adopt new methods that will have profound impacts on all aspects of their company's operations. The experiences of several experts on industrial extension programs are particularly instructive. One European academic had this to say:

> Ultimately, the barriers that prevent companies from identifying technological opportunities and moving towards them lie deeper than short-term policies can reach. They are rooted in organizational practices and cultural attitudes within the company that separate the R&D and engineering functions from core business decision-making. Companies can be encouraged to develop explicit technological strategies, but, in the long-term the solution lies in measures designed to shift cultural attitudes, beginning with management education.(Georghiou, in Branscomb etal, 1992, p. 146)

A director of a Massachusetts-based industrial extension program had this to say:

> Even those small manufacturers that are fairly technologically advanced are struggling to develop the new capabilities their large customers want — for example, advanced quality methods or expertise in product design. These companies don't just need technical assistance in incorporating new process technologies. They need an integrated approach to systems improvement across a wide range of organizational disciplines: defining new markets, training human resources, gaining

> access to capital, and forging long-term relationships with customers and suppliers. In my opinion we still know remarkably little about the kind of organizational infrastructure — change strategies, skills or resources — necessary to support small and midsize manufacturers in their efforts to achieve global standards. (Schneider, in Branscomb etal, 1992, p. 150.)

Similar statements can surely be made about government attempts to "encourage" firms to export or develop strategic alliances. These actions too are difficult for existing small firms to contemplate for reasons of cognitive limitations, deeply ingrained cultural attitudes and valid concerns about the risks involved.

"Individual firms must see the need for more innovative strategies, and must take the lead in shaping their environmental supports."

Government export promotion departments appear to operate on an underlying belief that if companies knew about the potential of exporting, then they would surely pursue it. But several studies show that small company owners are conceptually aware of the rewards of exporting: the barriers they face are more concrete, reflecting the realities of their companies and industries. Exporting is rightly perceived of as an intensive effort requiring large investments of time, effort and money. Accurate, up-to-date industry- (or niche-) specific international market intelligence is very difficult to access. The extra financing required is hard to come by. The owner/managers who head small manufacturing companies are usually extremely busy dealing with the day-to-day concerns that keep the business going. (Nothdurft, 1992, p.14)

Serious technological innovation or export marketing or strategic alliances inevitably affect the whole range of a company's practices and culture. Adopting new strategies of this magnitude is an uncomfortable act. The human need for stability and security and the resulting forces of organizational inertia are incredibly strong.

These realities are endemic in the small business sector. Before anything constructive will happen in terms of value-added economic development, individual firms must see the need for more innovative strategies, and must take the lead in shaping their environmental supports. Managers must have the time, information, and environmental support to develop and pursue innovative, value-added strategies. Public sector assistance will not be effective unless it addresses the realities of small firms, and not only responds to, but stimulates demand for tailored business support services. If small firms do not have a clear strategic orientation, and thus do not see their deficiencies and the need for modernization, then public programs are of little use.

"Survival depends on cooperating with other firms and local institutions."

From this basic reality, we turn now to the perspective of individual small firms as they face a new set of global forces and look at the strategies that hold the most promise for ensuring their survival and prosperity. Small firms cannot meet these challenges alone. In fact, their survival depends on cooperating with other firms and local institutions.

The questions then become:

- which forms of cooperation offer the greatest benefits for enhancing the international competitiveness of small manufacturers?
- how can this cooperative behaviour be stimulated in small firms when it is unfamiliar to them?

Global Forces Affecting Small Firms

International competition in manufacturing industries is intense and growing more so every day. The international trading environment features falling barriers to the

flow of goods, services and finance, and greater integration of international consumer and industrial markets. Today's manufacturers face competition not only from the United States, Japan and the Europe, but also from a whole host of hungry competitors from low-wage, but increasingly sophisticated developing nations.

The almost universal availability of standard production technology has made it possible for many underdeveloped nations to create export industries — sometimes in less than one generation. These nations use low-wage production of mass-consumption goods to enter global competition. Almost all developing countries (including China, India and the nations of Eastern Europe) now see this export-based strategy as the key to their national development.

Increasing competition has made it necessary for the developed nations' producers in to find new ways to set their products apart. Changes in quality, design, technological content and degree of customization have been introduced to more narrowly defined groups of customers. Customers, in turn, are learning to be ever-more demanding. In short, many previous mass markets once served by generic, high volume products have broked into numerous specialty niche markets. Within many of these niches, product life-cycles have collapsed to where only the latest innovation and quickest response to customer's changing requirements determine today's leader.

Rapid technological change is perhaps the most destabilizing force in international competition. On the production side, the larger variety of goods to be made and the speed with which they are redesigned require contant changes in production processes. So companies adopt new management methods and computer-based machines to provide flexibility at low cost and increased precision. Companies that master these technologies drive up the rate of change in quality, design, technological content and customization — in turn encouraging new generations of faster and smarter machines.

"Small firms able to innovate rapidly and produce efficiently in small-batches can do very well in global markets."

On both the production and product sides, strategic or enabling technologies — such as new computer, software and telecommunications equipment, advanced industrial materials and biotechnology — are transforming many industries. Rapid technological change can be a destabilizing force in any industry, one that can change the fortunes of a firm (for better or worse) virtually overnight.

To summarize, the international marketplace is characterized by increasing competition and technological change, the fragmentation of markets into more specialized niches, global competition within those niches, shrinking product life-cycles, and growing customer demands for ever-greater performance in quality, service, responsiveness and price. Firms that wish to survive must learn these new rules of the game and adapt accordingly.

SME'S in Global Competition: Strengths and Weaknesses

Strengths

In many ways, the characteristics of the emerging international marketplace are very well suited to SMEs. Customer intimacy, speed and flexibility are the hallmarks of successful small businesses. The newest advances in flexible production technology and management practices can put small producers on a competitive

cost footing with larger manufacturers who were formerly dominant due to economies of scale. In a world of niche markets, small firms able to innovate rapidly and produce efficiently in small-batches can do very well in global markets.

The global economy reflects these inherent strengths of smaller enterprise. The last fifteen years has seen a reversal of the historic trend toward large-sized enterprise in all the world's developed nations (Sengenberger etal, 1990). Since 1970, these nations have seen the average size of business units decline, with most employment growth accounted for by small- to medium-sized companies. While much of this trend can be tied to the emerging dominance of the service sector in advanced nations, the trend also holds for the manufacturing sectors. In the United States, for instance, the average factory shrank from 650 workers in 1970 to just over 200 by the late 1980s. Smaller firms with fewer than 50 workers create almost all the net new manufacturing jobs and an extraordinary share of successful new product ideas (Piore & Sabel, 1984). The trend toward smaller enterprise is global and seems destined to continue.

To a large degree, the trend has had negative implications. In many countries, including Canada and the United States, productivity is much lower in smaller manufacturers, as are wages, benefits, job security and training levels. Small firms in many sectors are not able to access the resources they need to be innovative and competitive, and are more vulnerable to demand and price swings in their industry. These conditions are prevalent in many small manufacturing sectors around the world (Sengenberger etal, 1990).

Weaknesses

The problem is that while there is an inherent logic to small-scale production in today's world, the requirements for constant technological innovation and global reach can make it very difficult for smaller firms to compete. The small firm's lack of resources confines its ability to:

- conduct extensive research and development;
- upgrade production capabilities, which might require investment in expensive new process technology;
- access professional services such as engineering, management consulting, accounting, market research and worker training programs;
- acquire intelligence on global markets;
- establish a credible presence in overseas markets;
- access adequate financing for investment; and
- fulfill larger contracts that require large volume production capacity or multiple skills.

Small Firm Positioning in Global Markets

Long-term survival in today's environment requires facing a number of important considerations. The considerations include: a) the non-viability of cost-based strategies, b) the insecurity of domestic markets, c) the need for focus, d) the need to think globally and strategically, e) the need for diffentiation, and f) the challenge of world class manufacturing.

Non-Viability of Cost-Based Strategies

Increasingly, offering generic ("me too") products and competing primarily on price is not a viable strategy over the long-term for Canadian manufacturers. New low-cost competitors from developing countries are bringing new manufactured products onto world markets, with the relative quality and sophistication of these products increasing all the time. Apart from resource costs themselves, Canadian manufacturers do not generally enjoy strong cost positions in activities driven by labour rates, productivity, or the age and efficiency of our capital stock vis-à-vis these competitors.

Global sourcing of materials through better transport links, and the greater use of synthetic materials and resource-conserving methods in end-market industries, are eroding the advantages of our proximity to raw resources. Global sourcing of inputs means that the prices of raw materials, fuels and capital are increasingly set on world markets and are converging for all major competitors.

In short, Canadian firms wishing to offer generic products on the world market find themselves in the modern dilemma described in this way by Robert Reich:

> Worldwide competition continues to compress profits on anything that is uniform, routine, and standard — that is, on anything that can be made, reproduced, or extracted in volume almost anywhere on the globe. The evidence shows that successful business in advanced nations respond to this dynamic by moving toward the higher ground of specialized products and services (Reich, 1991, p.37).

Insecurity of Domestic Markets

A second consideration is that clinging to one's domestic market in the hope of avoiding the new demands of the global marketplace is dangerous in the long-run. As communication and transportation links continue to improve and trade barriers continue to fall, a company that does not look outward and face global competition directly can expect to meet that same competition in its own back yard.

"As communication and transportation links continue to improve and trade barriers continue to fall, a company that does not look outward and face global competition directly can expect to meet that same competition in its own back yard."

For small firms in rich parts of the world, such as Alberta's manufacturers, the basic requirements for survival and success in today's demanding marketplace are quality, flexibility, speed and innovation.

A firm must:

- have excellent quality in its products and processes (i.e., so everything is done right the first time with no wasted time, energy or material);
- be flexible in response to changing demand for new products, new product features or specifications, new process technologies, and changes in product mix and production volume;
- be able to execute all the cycles of the business (product development cycle, customer feedback/improvement cycle, order fulfillment cycle, customer service cycle, etc.) with great speed — a focus called "time-based competition" (Stalk & Hout, 1990; Blackburn, 1991);
- have the capacity to innovate in order to match or set the technological standards of its industry; and
- have product offerings priced to achieve high relative value vis-à-vis competitors.

This list of requirements is a tall order for any firm (or group of companies), and represents an especially formidable challenge for small companies. In order to achieve excellence, some basic strategic orientations are required.

The Need for Focus

Small firms cannot realistically expect to meet the requirements just described unless they choose a limited number of highly specific market segments that closely match their skills, and then focus their entire effort on achieving and sustaining leadership in their chosen market. This means selecting appropriate product or customer niches in which to compete, and then leveraging the the firms special expertise through geographic rather than product diversification.

As a focused firm seeks growth, it finds a limited domestic market for its particular expertise. Rather than dilute their core competencies by expanding into new product lines, the evidence is that the most successful firms seek outside markets for existing products — global niches that play to strengths.

With this focus, the firm can develop strong bonds with smaller groups of customers and achieve a deeper understanding of their needs than competitors who serve larger or more diverse markets. It can:

- learn to anticipate emerging needs and invest its limited resources leading-edge innovations that meet those needs;
- curtail the complexity and effort required in its international market research by limiting the customers it serves and the competitors it must beat;
- develop a strong reputation within its industry and in the process make entry into international markets easier by setting itself apart from the crowd trying to serve the bigger, more generic segments;
- achieve a dynamic balance in its operations, in which it tailors its production to meet individual customer tastes within its niches while still achieving lower costs and overhead because its product scope is limited by its specialized niches;
- charge premium prices that still give high value to the customer.

"Rather than dilute their core competencies by expanding into new product lines, the most successful firms seek outside markets for existing products."

Nichemanship is not without risks. For instance, technological breakthroughs can make a product obsolete, resulting in the target market shrinking quite abruptly. But by staying close to customers and doing technological scouting (international trade shows, trade magazines, R&D organizations, etc.), it is likely that a focused firm will be able to anticipate or react creatively. If the firm has operated profitably in its niche and reinvested to built its own capabilities over time, then it has a chance to stay in the race through technological "leap-frogging." Or it can make a transition to new products and markets that utilize its skills and capabilities. In short, the risks of being an "also-ran" in larger market segments, or of diluting focus across too many markets, are far larger in a world of hungry, lower-cost competitors.

As we'll see, strategic cooperation with other small firms can reduce the risks of focus strategies. Networked firms create vocal demand for specialized infrastructure to support high value-added strategies. Networking can make it more feasible to collect intelligence on and penetrate distant markets systematically. Networked firms with complementary specializations can generate unique solutions and pursue more markets collectively than could the sum of individual companies' efforts.

A Strategic Mindset

Surveys of small firms (or networks) at varying levels of international marketing success show that those who are successful in export marketing or other international activities are much more likely:

a) to be operating from a strategic plan, and
b) to have built international aspirations into their plan early in the company's life (Nothdurft, 1992, p.15).

Strategic planning does not necessarily mean drawing up minutely detailed plans in a volatile environment. But an important part of a focus strategy for small companies is having clear and ambitious aspirations that focus the efforts of the company's employees and inspire the internal commitment and creativity needed for success. The aspirations should reflect a global perspective and striving for leadership within the company's niche. A strategic orientation also requires that SME owners or managers have the time and expertise to:

- monitor market and technological developments, in both the domestic and international arenas;
- carry out continuous product and process development;
- carefully analyze new investment opportunities; and
- maintain close relationships with leading edge customers in the firm's market niches.

The vast majority of small firm owners and managers are far too busy solving day-to-day production problems and trying to maintain a positive cash flow (Rosenfeld etal, 1992, p.12). Cut off from good information, especially on foreign markets, they tend to meet hard times by staying in their region and diversifying into areas in which they have marginal expertise.

"One extremely important differentiator for small firms is flexibility."

This consideration then is closely tied to the previous one — product focus with geographic diversification. Firms that have a clear strategy and international aspirations will be more likely to focus on their core strengths and leverage them to the greatest extent possible. For reasons we'll see below, networking with other small firms can maximize the chances for participating firms to develop new strategic planning ability and pursue international niche strategies.

Differentiation

Niche strategies make small manufacturers successful if firms differentiate their products within their niches. Successful firms develop a clear and unique approach to meeting customers' needs that customers value highly.

Each customer has a number of things they value including product reliability, speedy delivery, unique features and prompt and comprehensive field service. Some attributes will be more highly valued than others, and some will play to a seller's relative strengths. A good differentiator is a company that achieves a synergy between its relative strengths and customers' most important needs. In this way, it creates products that offer unique value. When successful, the product is exceptional in the attributes that customers value most and lean in the attributes that create little value but still contribute to cost (Porter, 1985).

Differentiation strategies guide a firm's investment decisions in a way that creates sustainable advantage over time and leverages scarce resources most effectively. A company chooses the approach that reflects its "core competencies" (Prahalad & Hamel, 1990) and builds on them by investing in the technology,

manpower, business processes and relationships that build unique capabilities over time (Stalk, 1992).

One extremely important differentiator for small firms is flexibility — the ability to tailor products to individual customers within chosen market niches. For this reason, mastering the new flexible manufacturing technology and management techniques described in the next section is extremely important. And networks contribute to flexibility by A) helping members learn the new techniques, and B) working as a unit to achieve fast, coordinated responses to target markets that no other production system can match.

World Class Manufacturing

Small manufacturing firms, in spite of nuances of their strategy, must determine and strive to meet global standards for quality, responsiveness and price (value for money) if they are to survive over the long-term. Around the world, leading manufacturing firms are shifting their production operations away from traditional methods toward a production model called "lean manufacturing", "flexible manufacturing", or "world class manufacturing" (Schonberger, 1990). The new model emphasizes:

"Companies that have incorporated 'world-class manufacturing' precepts into their operations are achieving striking leaps in quality and productivity and are raising the bar for other manufacturers."

- a disciplined, cross-functional approach developing new products and commercializing technology, with an emphasis on getting enhanced or new products to market very quickly;
- quality designed and built into the product rather than inspected for after production — achieved through an emphasis on customer listening, teamwork, cooperation with suppliers, and statistically-based process monitoring and improvement;
- high productivity and low working capital requirements through the simplification and streamlining of operations, local operator control, the elimination of overhead (including inventories), and the matching of production levels to demand;
- high flexibility through rapid machine change-overs, small batch production, cross-trained workers, and processes designed for rapid throughput;
- high levels of employee training and participation in quality monitoring and improvement;
- investments in flexible manufacturing equipment and information technology designed to enhance this production model;
- an emphasis on continuous improvement, learning and innovation in all aspects of the company's operations; and
- high levels of coordination among all firms in the value chain so that quality is enhanced, inventories and other costs are minimized, and time is compressed at every stage (this cooperation might extend from shared market forecasts, production schedules and market intelligence to "just-in-time" production and delivery, from shared product development, shared quality or operations improvement training programs and loans of technical personnel to joint purchasing, and even cross equity investment).

Companies that have incorporated "world-class manufacturing" precepts into their operations are achieving striking leaps in quality and productivity and are raising the bar for other manufacturers wanting to compete globally in the years to come. The increasing quality and delivery demands of customers are also becoming institutionalized through growing adoption of quality certifications like

ISO 9000. With Canadian manufacturers averaging a certification score of only 44% on ISO 9000 standards (Rowan, 1993a), it is obvious that we have a long way to go or risk being shut out of important markets.

The practices of world-class manufacturing are evolving swiftly due to both the emphasis on continuous improvement, and rapid advances in process technology. Firms or networks that hope to compete on in manufacturing successfully cannot afford to adopt generic, program-driven approaches to quality and productivity improvement. They must understand in depth how the new systems work and which tactics will produce the greatest improvements in their particular processes.

Most importantly, firms must put in place management systems that stress continuous learning and improvement involving everyone in the company. For many small companies struggling to maintain cash flow, shifting emphasis from minimizing labour costs to training and empowering workers might be the most difficult (though essential) requirement.

Networking can be a great impetus for continuous learning and improvement. Fundamental learning and profound operational changes are not easy to generate and sustain alone. The required inputs of knowledge, training and objective consulting expertise are expensive and time consuming to acquire. Old habits are hard to break. Problems and confusion arise that are best aired and resolved in an atmosphere of support and shared experiences. Perhaps the greatest benefit of networking lies in its potential to foster accelerated learning.

Small Firms Can't Do It Alone

The competitive considerations described above place an enormous burden on smaller manufacturers. It is essential that they leverage their scarce resources to the greatest degree possible. The most potent way to accomplish this leverage is through networking.

Across many developed countries, including Italy, Denmark, Germany, Japan and the United States, there are impressive examples of small companies banding together to help build specialized infrastructure, upgrade their capabilities and even attack global markets together. These groups are called "flexible manufacturing networks". Their cooperation results in strikingly competitive forms of industrial organization, allowing participating firms to address the competitive considerations described above. Networks represent perhaps the best way for many small manufacturers to achieve a competitive global presence and survive in the long-term.

The remainder of this document will look at how these networks operate and how small manufacturers can use this strategy in their industries.

Networking Among Small Firms

The most successful small manufacturers in today's world come from environments in which firms have learned when and how to cooperate to increase their competitiveness. Size matters less than the quality of the relationships tying them to other companies and to the local infrastructure.

Discussion of strategic cooperation between small firms is often clouded by confusion. The term *network* is loosely used to describe a whole range of cooperative activities from industry-wide, factor-creating cooperation to consortia-type

"The term network is loosely used to describe a whole range of cooperative activities from industry-wide, factor-creating cooperation to consortia-type work that usually involves smaller sub-groups of firms."

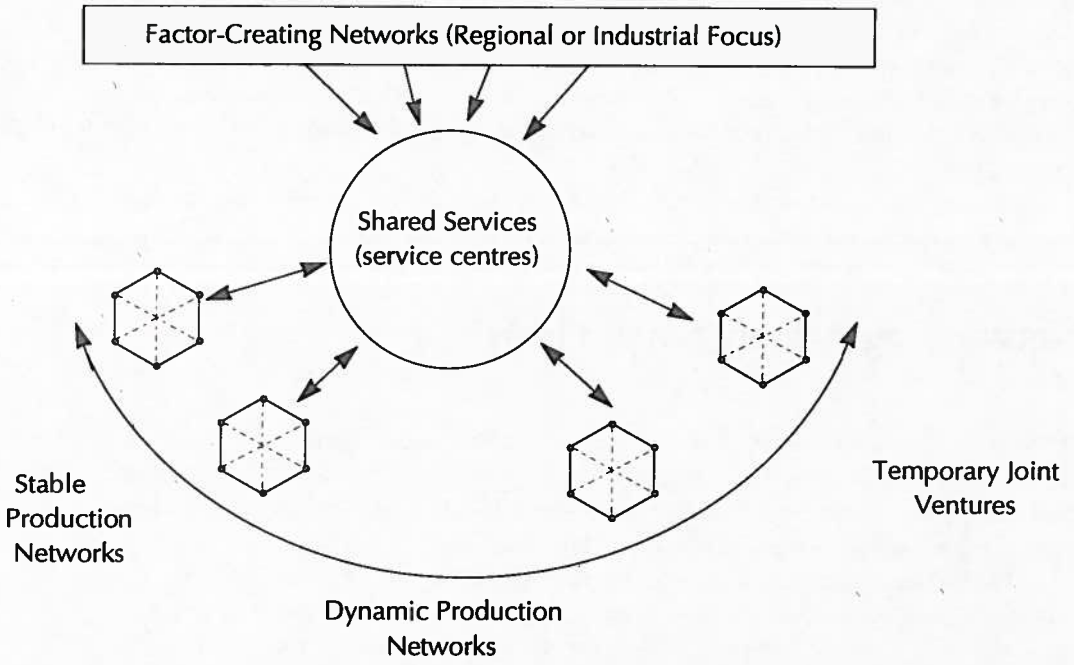
work that usually involves smaller sub-groups of firms. Making distinctions between different types of cooperation is important in understanding the many (often overlapping) forms that networks can take. The distinctions are also essential in determining how best to build competitiveness in particular local industries. Some critical distinctions will be made below, starting with the one between "factor-creating networks" and "production networks".

Factor-Creating Networks

The most basic and important type of cooperation between firms happens in factor-creating networks — collective efforts to build and sustain an infrastructure of factors tailored to an industry's needs. The factors are made available to all participating firms, no matter how small. This activity is usually accomplished through strong trade associations, or more narrowly focused sub-associations and service centres, working in close cooperation with local governments, educational and research institutions. Factor-creating networks engage in several key activities. They:

- put together training and apprenticeship programs, and operate training centres;
- investigate, introduce and even house collective investments in process technology;
- sponsor university (and research institute) research;
- work to promote quality practices and certification in their industries;
- collect up-to-date, industry-specific information on international markets and competitors, technological and market trends;
- organize trade fairs and other broad industry marketing activities; and
- facilitate social interaction and information-sharing among members (which may set the stage for greater cooperation).

Figure 1. Distinctions in Networking



Market information has traditionally not been considered a factor of production. However, it should be considered one of the most basic and important factors, for reasons discussed in depth further on.

In factor-creating cooperation — common in Germany, Denmark, Northern Italy and Japan — firms still compete fiercely, but also recognize the need to participate in continuously upgrading the pool of factors from which they all draw. The factors can be considered pre-competitive in the sense that they benefit all firms without curtailing competition. Their purpose is to raise the standards of domestic competition so that the industry as a whole is competitive internationally.

Factor-creating networks have no real equivalent in most North American manufacturing industries. In Europe, leadership in factor-creation comes largely from chambers of commerce and trade associations; the range of activities they pursue is far wider and has a different focus than most of their North American equivalents. Trade associations in North America tend primarily to be lobbying organizations. Some also provide low-cost insurance and some training, sponsor trade shows, and publish buyers' guides. However, their general focus seems to be on lowering regulatory constraints and achieving special exemptions for their members. In the words of one expert on international competition:

> This squanders their important potential benefit. When management recognizes that the pool of national factors is essential to success vis-a-vis firms from other nations, the view taken toward the role of trade groups is often profoundly altered. (Porter, 1990b, p.594)

This is certainly the view of many European firms. While many of them (for instance in Germany) operate in environments with far greater levels of government regulation and restrictive social policies, their associations still take a far different stance than is usual in North America. Their mindset is focused on innovation and high quality as a source of competitive advantage; they worry relatively less about static cost conditions and far more about their strategic capabilities.

"Factor-creation networks raise the standards of domestic competition so that the industry as a whole is competitive internationally."

Production Networks

Upon this broad, solid base of specialized infrastructure, many smaller groups of firms go further, undertaking joint production and marketing work. Each group takes its own unique, often highly fluid form, and evolves over time in response to market opportunities and demands. For the rest of this paper, we'll avoid the unwieldy term "joint production/marketing networks" and use the generic term "production networks" to mean any group working to penetrate markets together. A study on this new form of "flexible specialization" (Piore & Sabel, 1984) identified two types that form poles on a continuum — "kingdoms" and "republics".

Kingdoms tie small suppliers to large customers in a vertical supplier chain, under the strategic direction of the big company. Kingdoms usually take shape in markets that feature high volumes and complex products with many components and subcomponents (automobiles, photocopiers, etc.) This structure is typified by the highly successful Japanese supplier-group system in which the large manufacturer concentrates on design, marketing and assembly while subcontracting major portions of the parts manufacturing to smaller companies with which it retains close, collaborative relationships (and often an ownership interest). The practices of total quality control, just-in-time parts delivery and collaborative engineering make this a highly integrated, yet flexible system. As these practices catch on in North America, the bonds between large manufacturers and smaller select groups

of suppliers are becoming much closer, though the degree of cooperation does not yet approach that found in Japan.

Republics tie small suppliers to each other in horizontal networks in which no single firm dominates. Small specialty producers, usually concentrated in a small geographic area, work together to produce complete components and finished goods. Unlike subcontracting, the firms involved use their collective resources to sell directly to end-use markets. Over time, varying numbers of firms come together in ever-changing patterns according to the needs of the market. Strategic direction is provided not by a dominant large company, but by a broker who coordinates the efforts of member firms to attack global markets. Republics are most advanced in the industrial districts of Italy, Germany, and Denmark, where entire regions have developed thriving manufacturing sectors based on this model.

Again, these models are extremes that form ends of a spectrum. Hybrid forms of networking exist in other places. Some small-firm groupings may have a relatively dominant "lead firm" that, though small, establishes the relationship with the end customer and brokers the rest of the component work that needs to be done. In another hybrid, exemplified by Silicon Valley's newer generation of chip manufacturers, small, innovative companies band together (as in republics) while including in their partnerships much larger companies — though the large companies in no way dominate. These small companies, on the edge of technological innovation, are engaged in a myriad assortment of alliances. (See the Appendix for a description of Silicon Valley's networks.)

Production and marketing networks are linked to factor-creating networks in the sense that they can facilitate the creation of ever more narrowly specialized infrastructure. As production networks take shape in particular communities or regions, they come to rely on local community institutions — universities, community colleges and the municipal or regional branches of national institutions — to provide services collectively that are more narrowly targeted to the local network(s). And as they become more interested in each other's basic competitiveness and share selective information with each other, production networks also become a source for disseminating management and technological innovations.

Models for Alberta?

Because Alberta's value-added manufacturing industries are populated most prominently with small firms rather than large, integrated producers, the kingdom model prominent in Japan will not be the focus here. A much more fruitful line of inquiry will be to study factor-creating cooperation and the small firm-centred Republic model prominent in Europe. With this in mind, it is time to look at some prominent examples of effective cooperation in Europe and the United States.

Section II:

Learning from Networks in Other Nations

Italy: State-of-the-Art Networking

Republic-style networks first evolved in the northern Italian district of Emilia-Romagna. With a population of only four million, the region now has 90,000 manufacturing companies, the vast majority with 50 employees or less. They are concentrated in industry clusters in and around the cities of the region (Bologna, Modena, Carpi, Sasaullo). The dynamism of small manufacturers has transformed Emilia-Romagna from one of the poorer regions of Italy into one of the most prosperous regions in all of Europe, with a per capita GDP 27% higher than the Italian average. Small companies account for 40% of employment and operate in a number of industries, including machine tools, automatic machinery (robots), motorcycles, automobiles, electronic controls, textiles and apparel, and ceramic floor and ceiling tiles. Although most of these firms are tiny, they compete globally in many high value-added niches requiring state-of-the-art technology.

Small Firms in the Robot Business

FSM, a robotics manufacturer with only 16 employees, brokers a small network that is globally competitive in its niche of diesel engine robotics. FSM handles system design, assembly, testing, and global marketing. Five other local companies, none of them with more than 20 employees, supply electronic controls, machining, hydraulic components, welding and fabrication. Each of the firms began as captive subcontractors of larger companies. Now they work together to produce high-value products for the export market.

Factor Creating Networks

At the heart of Italian industrial districts are strong trade associations, sub-associations and sector-specific service centres. The national artisan's trade association (CNA) provides tax accounting, regulatory and financial advise for members in local centres. Associations also work with local training and educational institutions to create a supply of highly skilled craftspeople who are knowledgeable in the newest technologies.

In 1974, the regional government created ERVET, a development agency. ERVET established sector-specific "hubs" or "service centres" for the region's most important industries. The small firms that use (and pay for) the hubs' services define hub functions. Today, ERVET administers 12 centres — 10 for specific industries and 3 addressing the cross-cutting needs of computer-integrated manufacturing (ASTER) and export promotion (SVEX and RESFOR). Membership fees from firms, trade associations, chambers of commerce and unions provide the bulk of support for the service centres, though they are not completely self-sufficient (Rosenfeld etal, 1992, p.73).

Tailored Export Promotion

SVEX and RESFOR, the export promotion service centres established in 1988, are good examples of regionally-based (as opposed to industry-specific) factor-creation that still delivers very tailored services to local firms. SVEX and RESFOR also demonstrate the power of information in transforming small firms.

SVEX was designed to overcome two problems. Before SVEX, the regional chamber of commerce helped small firms participate in international trade fairs but had no way of insuring that firms followed up on leads (and made the chamber's investment worthwhile). And the government agency providing international market information was not able to deliver detailed service useful to niche marketers.

SVEX aims to establish long-term trade relationships in selected sectors between Emilia-Romagna firms and carefully targeted overseas markets where it perceives the region has a competitive advantage. It focuses on untapped but potentially important markets like Japan, India, and the former USSR. It conducts detailed market analyses, takes groups of local firms to appropriate trade events in the target market, invites foreign officials to Emilia-Romagna, and eventually establishes a permanent agent in the market. Seed-funded by ERVET, it is working toward self-funding through fees charged to clients.

Another innovative local institution that provides a complementary service to small firms is RESFOR, The Subcontractor Network of Emilia-Romagna, established in 1988. RESFOR is basically a detailed and continuously updated database on the production capabilities of its 600-plus member firms in the metalworking, rubber, plastics and electronics industries (80 percent with less than 20 employees). It is able to provide any major manufacturer in the world with complete technical profiles of RESFOR members. The profiles describe plant location/size, number and skills of employees, capacity, sub and non-sub products, R&D history, patents held, quality control procedures and certifications, and so forth. The members also get detailed profiles on the large contractors seeking subcontractors, outlining corporate structure and history, production throughput, subcontracting practices and payment terms. In addition RESFOR represents member firms at international trade fairs and keeps them abreast of emerging sectoral market trends.

Inquiring firms get a short printout of subs that meet their specifications, and are charged more for detailed profiles. Members pay a yearly fee of $250 American. RESFOR was established with ERVET funding but is expected to be self-funded by 1995.

One of these service centres is CITER — the local textile industry's collective service centre. This centre has a membership of 600 local textile and apparel manufacturers. The centre keeps its members informed of the latest industry trends and fashion information through meetings, seminars and publications. More importantly, it also provides some of the most sophisticated design services offered anywhere in the fashion industry. CITER has developed a special CAD system for fashion — a system which has on its database over 50,000 elements (colours, patterns, fabrics) that can be combined in a vast number of combinations. This system allows member designers to try many more options than would be possible by hand or by using an individual CAD system that lacked CITER's library.

Flexible Production Networks

Surrounding these service centres are ever-changing groups of firms (production networks) who design and manufacture products as opportunities are scouted on international markets. These knit-wear consortia are brokered by impannatore — merchants who stay close to high-fashion markets, who work to shape and respond to fashion trends, and who bring home orders and organize production.

The *impannatore* encourages experimentation and innovation among the small specialized firms in the production networks, and protects them from cutthroat competition in a number of ways. If one company is aggressively cost- and price-cutting by "sweating labour" or any other tactics not acceptable to the industries informal norms, then the impannatore tends to cut the firm off from access to orders. If a company's experimentation with a new fabric or piece of clothing misses the trend one year, then the brokers will expect the more successful firms to subcontract excess production to the slow firm (knowing that roles may well be reversed next year).

"Small companies compete vigorously to join the most dynamic and profitable production networks."

These informal rules insure that horizontal networks maintain a dynamic balance between cooperation and competition. Small companies compete vigorously to join the most dynamic and profitable production networks. The informal rules and a strong cultural professional pride compel members to compete on innovation — to hit the fashion trend this year with a unique product and secure the more lucrative primary contract. The reciprocal subcontracting to competitors lowers the risks of undertaking innovative experimentation because there will always be some work to fall back on each year even if the innovation fails.

The innovative balance between cooperation and competition, combined with the supportive infrastructure, results in strong incentives for firms to develop great expertise in narrow specialties and to invest in the latest capital equipment, no matter how small the firm. Very small firms own CAD systems, numerically-controlled and computerized (NC/CNC) machine tools, and other advanced equipment.

Recently, the cooperative elements of the system have been enhanced by unique forms of capital investment. Many Italian networks invest in computer networks. The equipment is used for computer-based conferencing to organize "spot markets" for jobs, facilitate production coordination and joint ventures, and provide on-line technical consultation. Some networks also feature common NC/CNC equipment so that winning orders that must subcontract excess production (or large orders that cannot be met by single producers) can readily be programmed into numerous machines with no delay.

As a competitive strategy, this ability of the network as a whole to "ramp up" production of winning products and cut off production of losers on extremely short notice guarantees hypersensitivity to volatile markets. Italian networks are "dynamic" rather than "static" because their forms are constantly changing.

"Italian networks are 'dynamic' rather than 'static' because their forms are constantly changing."

Finally, Italy's dynamic networks are a hotbed for "blue-collar entrepreneurship." Because the small company support structure is so solid, and because of the constant flux in networking relationships, many skilled workers with bright ideas find it very attractive to go into business for themselves. In fact, the northern Italian business culture has essentially defined a new career path — from technical school student to employee to small firm owner. Entrepreneurship is an important source of innovative vitality in Italy's networks.

Germany: World-Class Factor-Creation and Nichemanship

Industrial cooperation has existed for many years in Germany — where, as in Italy, a unique infrastructure dominated by industry insures a particularly dynamic form of industry cooperation.

The heart of German competitiveness is their *mittelstand* (mid-size manufacturing companies) that operate in small, specialized niches such as labeling machines for beverages, bookbinding textiles, metal filters, food for tropical fish, high-end educational toys, and highly specialized machinery of all sorts. *Mittelstand* are usually on the leading edge of innovation and pursue global strategies. They are a dominant force in the German economy and account for the bulk of Germany's large trade surpluses — a considerable feat considering Germany was the world's largest exporter in 1986, 1987, 1988 and 1990 (Simon, 1992).

The key to the success of German SMEs is "the quality and sheer depth of mechanisms in Germany for creating advanced and specialized factors (i.e., skilled labour, advanced research, etc.)" (Porter, 1990b). According to Michael Porter's research in The Competitive Advantage of Nations, these mechanisms are "unmatched in any nation we studied."

Taking the lead in factor-creation are 83 local chambers of commerce, who enjoy public-law status. Membership is mandatory for all firms (the same is true in Italy and France), giving the chambers tremendous resources. Local chambers manage Germany's world-leading industrial apprenticeship programs, arranging placements and monitoring progress. Together with strong trade associations, they maintain close ties (and considerable influence) with local universities, technical colleges and research institutes. They broker technology transfer activities between these institutions and local businesses, sponsor seminars for SMEs about R&D opportunities, organize institute visits and make business referrals. They publish magazines to promote partnering opportunities and advertise new products available for liscencing. Some assist in negotiations between big firms and small ones, or act as brokers for groups of firms wishing to undertake joint product development, production or marketing efforts (Nothdurft, 1992; Rosenfeld etal, 1992).

"Taking the lead in factor-creation are 83 local chambers of commerce."

Entrepreneurial Technology Transfer

One example of an innovative local institution, in Germany's Baden-Wurttemberg district, is The Steinbeis Foundation for Technology Transfer. Steinbeis is a public corporation that emphasizes hands-on technical assistance to smaller manufacturing firms. It gets most of its income from client fees. It uses an entrepreneurial strategy to get technology out to new firms — by making direct grants of up to $100,000 to new start-up consulting practices. Once launched, each specialized service is expected to run as a profitable enterprise, selling its services at market rates. As they move from plant to plant, the consultants act as pro-active brokers, identifying opportunities for local firms to network, building the collective strength of Baden-Wurttemberg's many small and medium-sized enterprises. So far, 60 of these consultancies have been created, with several that have grown to considerable size.

Germany's strong local institutions also take an aggressive role in ensuring that companies of all sizes pursue high value-added, specialization, export-oriented strategies. In some ways, the German environment requires these strategies. German customers are obsessed with quality and performance. Environmental and product safety regulations are among the highest in the world. And small companies face the same labour force demands (strong unions, mandatory high wages and short work weeks) as large ones. However, German industry groups facilitate the strategies as well.

SMEs in most German jurisdictions can apply to their local chamber of commerce for in-depth international market intelligence, which the chamber can access through its affiliate organizations in 43 countries, or through a government agency. With the payment of a fee reasonable to small firms, firms can access export advice, information on foreign customs, law, and taxation, trade leads, sales representative searches and even tailored analyses of target foreign markets.

Some associations go even further to facilitate international niche strategies. The machinery industry in Baden-Wurttemberg, centred in Stuttgart, features many small firms with general-purpose equipment and highly skilled workers. To avoid having their flexibility result in "excessive" competition, formal and informal industry understandings have been instituted that focus particular firms heavily into niche markets. As a consequence, not only do machinery producers agree to specialize in particular product lines (textile machinery, metal cutting machine tools, etc.), but firms in the same general line of business coordinate their areas of specialization to avoid duplication.

When these specialized firms face downturns or structural threats to their industry niches, previous agreements arranged through the trade associations preclude them from diversifying into related product markets. They are thus forced into intensive innovation to stay on top of their specialized niches. The result is strong incentives to stay very close both to their customers and suppliers, who serve as sources of technological know-how and market intelligence. Companies grow through geographical diversification in their niches and many of them dominate their chosen niches worldwide.

Though these companies still tend to approach the market alone rather than through republic-type networks, they cooperate extensively on insuring high quality infrastructure and they maintain extremely close relationships with suppliers and customers. Through mechanisms such as the Steinbeis consultants, more production networking is beginning to unfold. Generally though, the German example emphasizes the power of strong industry-specific infrastructure combined with niche strategies.

Denmark: Aggressively Promoting Joint Production

A recent example of an aggressive and successful attempt to establish production networks occured in Denmark. In 1988, the small nation of 5.1 million people had a manufacturing sector characterized by independent small firms often not competing to world standards. These firms tended to be fairly export-oriented, were backed by a strong infrastructure of technical training and technology transfer, and had some experience through trade and industry associations with joint purchasing and learning exchanges. Still, production networks had little basis in cultural or economic traditions. Faced with the prospect of being overwhelmed

in a more integrated European Common Market, in 1989 the nation embarked on an intensive campaign to promote networking among Danish firms.

The campaign was designed to create maximum short-term awareness and back it up with "seed money" for any group of companies that could come up with a specific viable plan for building a production network. The government launched an intensive campaign to educate the public, it conducted research and analysis work (sectoral analyses, standard legal contracts for different kinds of networks, tax implication studies, etc.), it trained 40 highly experienced industry advisers (bankers, accountants, lawyers, consultants, etc.) as brokers to facilitate cooperation in fledgling networks, and finally, it offered three stages of financial incentives for cooperation.

The definition of network was left very loose so as not to proscribe creative competitive alternatives: "A network is the cooperation — and the mechanisms for cooperation — enabling the small company to compete successfully with the best of big companies." As long as the cooperation involved three or more companies engaged in two or more cooperative activities aimed at new business opportunities, new markets or building or maintaining a competitive edge, it was a network. Bureaucratic restrictions and complexities were kept to a minimum. Reflecting the belief that networks should be self-sustaining over time, the program was due to end in 1992. By 1991, more than 3,000 of Denmark's 7,300 small manufacturing firms were involved in networks.

A Danish Network: Aids for the Disabled

An early example of a successful network was called Production of Aids for the Disabled. Denmark had a number of very small, skilled ergonomic products manufacturers, all serving one large customer — the Danish Public Health System. The group was threatened by a number of dangerous trends: reduced public spending, growing international competition, and technological shifts toward embedded electronics and new materials in which they had no expertise. These firms had absolutely no marketing experience.

To meet these challenges, a large group of these companies established a common service centre (called DATCH), working in conjunction with associations for the disabled. In the service centre, the firms located — and jointly financed — resources that were seen as joint solutions to common problems. They included expertise in design, ergonomics and embedded electronics; the monitoring of markets and technology; international marketing and quality assurance. The centre is now run by a special kind of broker trained in the Network Broker Training Programme at the Danish Technological Institute (more will be said about these special network brokers).

The participating companies are in an intensive and ongoing negotiation process to capitalize on their mutual complementarity. In terms of products, equipment and markets, they seek a more specialized division of labour, thus sharpening the business focus of each company, utilizing resources more to capacity, saving heavily on investments, and offering a more complete product line in joint marketing efforts.

The companies are jointly developing their subcontracting relationships. In one direction this means jointly qualifying as subcontractors to very large companies. In the other, it meant jointly finding a highly qualified partner/subcontractor in the field of electronics, one that would be willing and able to work with them in the enhancement of existing products and the development of new ones. No one

firm in the network would have proven an attractive customer to the best producers of embedded electronics, but they have proven to be an attractive partner as a group.

More Danish Networks

- Pro Audio: thirteen electronics firms with differing specialties (circuit design, customized loudspeakers, acoustics, digital recording systems) operate as a marketing cooperative to design and market custom turnkey sound studios for the professional market.
- CD Line: Eight textile and apparel manufacturers producing complementary products market their goods in foreign markets as a complete product line, share joint quality assurance and marketing personnel, and jointly subcontract high level designers. The firms are jointly investing in EDT business links.
- Fast food: A large number of primary and secondary food producers have formed a network to compete in a higher value-added market by developing, producing and marketing high price fast food products. They have jointly subcontracted the processing facilities and a packaging producer, just as they have jointly been able to sell their products to supermarket chains. The joint resources even include well-known chefs who "design" the products.
- Golf Courses: A group of landscape gardeners who were suffering from a downturn in the Danish building industry established a network on the idea of marketing golf courses. The group studied best practices in the U.S. and jointly imported specialized know-how and equipment. They jointly financed a landscape architect, and they are marketing internationally with remarkable success.

The Danish networking experiment is still unfolding. So far, the effort seems a spectacular success, indicated by the following survey feedback from network participants:

- 42% realized new sales,
- 67% reduced costs,
- 75% believed they had become more competitive, and
- 94% would continue to collaborate after the subsidies had ended.

The Danish Model: Considerations Worth Remembering

Most of the new Danish networks are focused on building complementary production and marketing between small firms. It is important to remember however, that this production networking is happening on a firm foundation of previously-established modernization infrastructure, one that is "very comprehensive, accessible, and well-organized" (Rosenfeld etal, 1992, p.72). In a country of only 5 million people, the infrastructure in place to support SMEs includes:

- The Danish Technological Institute, a private business founded in 1906 to support technology development, considered to be one of Europe's premier research and technology deployment centres (Nothdurft, 1992, p.19),
- publicly-funded technology information centres in every county, each staffed with extension agents providing information in the field,

- decentralized applied research centres, and
- technology application centres in seven technical colleges (Rosenfeld etal, 1992, p.72).

The Danish networking program was not an isolated modernization program. Proponents of copying the Danish model would be well-advised to keep this in mind.

Another fact worth keeping in mind was the scale of the new program. Networking was not an "add-on" program: it replaced the Danish government's comprehensive export market development program and several other programs, and committed $25 million over three years in a campaign that was of sufficient scale to transform the way business was done in both the private and public sectors. Denmark was willing to commit to a transformative policy, knowing that its small manufacturers had the basic skills and infrastructure in place to be competitive, and perhaps guessing that the emerging European Common Market provided a strong incentive for firms to upgrade their capabilities in short order.

"Networking was not an 'add-on' program."

Over the next few years, it will be interesting to see how dynamic the new production networks become as firms get used to network cooperation. The initial efforts almost require static membership in order to build trust, stable relationships and a feel for how cooperation works. The extreme hypersensitivity to markets that makes Italy's networks so competitive, however, will only be duplicated if the cooperation becomes more flexible and spontaneous over time.

In the excitement of discovering the unique forms of export-creating cooperation unfolding in Europe, it is easy to overlook or underemphasize the base underlying their success. Each of the successes in joint marketing or product development described was built on a long tradition of extensive public-private sector partnerships and industry-led factor creation. Most industries also had a history of craft-based skills going back several generations. It will become apparent as we look at America's experience of trying to import European-style networks that the European experience is not easy to recreate. Efforts must start by addressing the fundamentals.

America's Network Experience

Spurred by these European success stories, several local, state and regional governments in the United States have taken to the idea of flexible manufacturing networks and have been promoting the idea to local industry through the use of challenge grants and other mechanisms similar to the Danish program. While none are as comprehensive as the European examples, they do show that the idea of networks is catching on, and can work, in North America.

"The European experience is not easy to recreate. Efforts must start by addressing the fundamentals."

States with active network promotion programs include Oregon, Washington, Minnesota, Michigan, Pennsylvania, North Carolina, and Arkansas. Some states are also entering into regional promotion efforts where their industrial geography calls for it (Michigan/Ohio/Indiana, for instance and 12 southern states in the Southern Industrial Competitiveness Project). According to best estimates, there are about 80 networks presently active in the U.S. (Bosworth & Rosenfeld, 1992, p. 28). These networks are most evident in industrial sectors such as metalworking, wood products and apparel — those hit hardest by international competition. They usually result from public programs designed to promote networking along with manufacturing modernization. Examples of specific network initiatives across the United States are described in the Appendix.

The networks resulting from these initiatives are in their infancy. Most groups have gravitated toward achieving beneficial economies of scale — activities that provide cost-sharing and thus immediate savings to members (shared front office systems, market research, training, equipment, etc.). From a strategic viewpoint, the most common primary network goal seems to be joint marketing (Bosworth & Rosenfeld, 1992, p.29).

America's experience to date with networks has given rise to several issues that could be instructive for Alberta firms and institutions interested in neworking.

Confused Mandates?

Many promoters of American networks find the dual emphasis on cost-savings/joint marketing troublesome, and feel instead that networks should be working more actively toward modernization. That is, networks should be focusing their efforts on advances in manufacturing technology and business practices that would lead to higher value-added products (Bosworth & Rosenfeld, 1992, p.30).

In effect, American network promoters are feeling a need for networks to fulfill the role of "factor creating" institutions, as well as operating as production networks. In Europe, the institutions that work to enhance access to training, market intelligence, technology, shared services and capital are distinct from the smaller groupings that market or produce products jointly. The smaller networks play a role in specialized factor creation (witness the Danish service centres), but they do it on an existing base of wide industry efforts.

In America, this distinction is not evident. Though each network seems to have a different focus (see Appendix), relatively small networks are expected to pursue mandates that cover the gamut from basic factor-creation to sophisticated joint production and marketing activities.

This is probably the case in America because of the absence of anything approaching the sophisticated, industry-driven factor-creation mechanisms existing in Italy, Germany and Denmark. Economic development policies and trade association priorities in America have left a vacuum that many people hope networks can fill.

Limited Joint Production and Specialization

Another concern expressed about the new networks is that, although many of them avow an interest in joint production, very few are actually doing it. In Europe, joint production networking has facilitated the shift of many small firms into more narrowly specialized lines of business; networking enhances the rewards and seems to lower the risks of specialization. If American firms do not show these behaviours, then it suggests they have not developed the trust relationships necessary to focus their individual specializations more narrowly and develop joint products of the highest innovation and quality.

Static Structures

A related concern about fledgling American networks is that they seem to be developing along the lines of a static rather than a dynamic model. That is, their efforts have been directed toward building networks with defined, limited memberships and stable internal structures. The networks are defined by small groups of

firms that see each other as "designated cooperators" for a range of joint activities that starts narrowly and broadens over time (Bosworth & Rosenfeld, 1992, p.28). This is in contrast to the far more dynamic Italian experience, where large groups of members support a common infrastructure, but the shape of market activities is such that multiple smaller network relationships evolve and dissolve almost organically in response to market requirements. Dynamic networks tend to be a greater impetus to innovation and learning because, besides being more responsive to changing markets, they keep the onus on members to improve and innovate in order to capture and retain positions in the most lucrative network activities.

A Common Pattern

At the heart of many of these issues is the concern that American SMEs, and their budding networks, lack fundamental competitiveness — that is, the capability to perform at high levels of quality, productivity and innovation. Thus, American promoters of networks hope networks will be a strong catalyst for modernization, innovation and competitiveness-building activities. Instead, they see many American networks focusing too heavily on short-term cost-savings:

> In America, small firms are most focused on improving the bottom line in real time. To buy into a network, individual firms must be able to see its potential to render a tangible and fairly short-term impact on that bottom-line. Further, small firms feel that taking on modernization activities might "expose" each firm's organizational and technological weaknesses; thus it requires a higher level of trust among members than is likely to be realized in the simpler cost-saving activities that most emerging networks pursue (Bosworth & Rosenfeld, 1992).

Forming networks is no guarantee that participating firms will focus their efforts on true competitiveness-building activities. More is needed.

"Good programs both respond to and stimulate demand for modernization assistance."

Focusing on Modernization

Innovative American states are focusing on supporting the modernization of their small manufacturers, and networking is only one of the European practices they have been adapting to their environments. Some of the other ideas are worth exploring here in the context of small company modernization.

Studies of the best practices to emerge from experiments in American states (Rosenfeld etal, 1992) reveal that the most effective programs demonstrate the following principles:

a) They begin by developing a strong understanding of local economies by "mapping" the SME population in terms of their industry, location, and their linkages with each other and larger firms (this analysis involves both economic analysis and surveys to find out who firms' suppliers and customers are).
b) They target critical industries and organize services around industry (or sometimes regional) clusters.
c) They involve SME owners in their design and planning through industry associations, advisory boards, or focus groups.
d) They are comprehensive; that is, they begin with firms' needs rather than the expertise of specialists, they act to coordinate existing services and they reinforce services that inadequately serve the client base.

e) They are accessible to firms in all communities, of all sizes.

f) They both respond to *and stimulate* demand for modernization assistance from SMEs through the use of comprehensive assessments of individual firms, demonstration of new process technologies and techniques, and industry benchmark information.

With these principles in mind, innovative states are trying many different approaches to enhance their services to SME manufacturers. For instance, many programs use skilled evaluators to help small company owners identify deficiencies in their operations. The best evaluations link recommendations for technological improvements to market information by making firms aware of growing customer demands for quicker delivery, ISO 9000 certification and so forth.

Many programs make use of local community colleges (and even mobile demonstration units) to demonstrate new process technology and to deliver accompanying training. Small firms can observe or test new processes, train workers and even build prototypes.

Most programs focus heavily on facilitating tailored work force training for important local industries. Some are beginning to work with local industries to develop youth apprenticeship training programs.

Some programs are using modern technology to create, and make available to small companies, databases that include information on training programs, government regulations and services, rosters of consultants and university experts, large company bid tenders, import/export opportunities and used equipment listings. Some databases even provide on-line literature searches, interactive expert systems and business education.

"The driving force of the best programs is the continuous challenging and empowerment of small firms to pursue systemic change and long-term upgrading."

Finally, many programs promote Danish-style networks through the use of challenge grants and trained brokers.

The key to the evolution of these programs is a symbiotic relationship between the agencies and the client companies. Applying the above principles gives rise to creative solutions that fit the local context. The driving force of the best programs is the continuous challenging and empowerment of small firms to pursue systemic change and long-term upgrading. Networks are only one part of the most effective programs. (For an excellent analysis and description of emerging "best practices" in U.S. states, see Rosenfeld etal, 1992.)

In comparing these exciting U.S. initiatives to their counterparts in Europe, several factors are limiting the positive impact so far. One is that the Americans have simply been using these principles for a much shorter duration than the European cases. Another is that the American programs do not have a level of commitment and funding comparable to the European cases (for instance, Rosenfeld etal, 1992 describes one of the best state programs being cut with the arrival of a new state administration). The final limiting factor is that the European system features more active, and better organized, industry participation and delivers many important services through private groups. European modernization programs experience far more sophisticated demand from industry.

The networking experiences of Europe and the United States show that networks should not be taken out of context. The consensus of one forum of networking practitioners (held in Aspen, Colorado, July 1992 — final report in Bosworth & Rosenfeld, 1992, p. 30) was that "networking is not a way to make inefficient, non-innovative firms efficient and innovative by just joining them together." The goal is innovative and competitive small companies, not networks themselves.

This consensus generates a more productive line of inquiry about networks — a way of putting them in their proper context. The question that should precede networking efforts (especially promotion of production networks) is: "What makes small manufacturing companies innovative, internationally competitive, and successful?"

From an understanding of these basic attributes, other questions follow: "What role can networking play in making this happen?" "What form should networking take in North America?"

We turn then to the general question of small company competitiveness and the potential role of networks in facilitating it.

Networks and Long-Term Dynamism

The driving force of competitiveness is innovation. Networking efforts will be beneficial in the long-term only to the extent that they nurture innovation within their ranks. To work as a long-term strategy, networking must be part of an overall strategy to drive constant improvement, innovation and dynamism in manufacturing sectors.

Creating an innovative dynamic in a local industry is essential for the long-term health of firms within the industry. Innovative firms tend to emerge from certain kinds of environments, and it follows that any firm, no matter how small, must monitor the health of its domestic industry (and related infrastructure) if it wants to establish itself as a successful manufacturer in global markets. To see why this is so, it is helpful to look at the comprehensive research conducted by Michael Porter in his book The Competitive Advantage of Nations (1990b).

"Most important to sustained advantage is to develop highly advanced pools of skills, technology and infrastructure tailored to specialized industries."

The "Competitive Diamond"

Porter's research shows the regularity with which firms from one or two countries achieve disproportionate worldwide success in particular industries. Examples include printing presses and chemicals in Germany, pharmaceuticals and chocolate in Switzerland, consumer electronics and robotics in Japan, ceramic tiles and factory automation equipment in Italy, mining equipment and heavy trucks in Sweden, and the list goes on (Porter, 1990b, p.19). The geographic concentration of an industry's leading competitors can often be traced even further to particular regions or even cities within those countries. To find geographically solitary world leaders is rare. Some environments seem more stimulating to advancement and progress than others. In short, it is clear that competitive advantage is most often achieved through a highly localized process, and that attributes of certain societies seem more apt to nurture champions in particular industries than others.

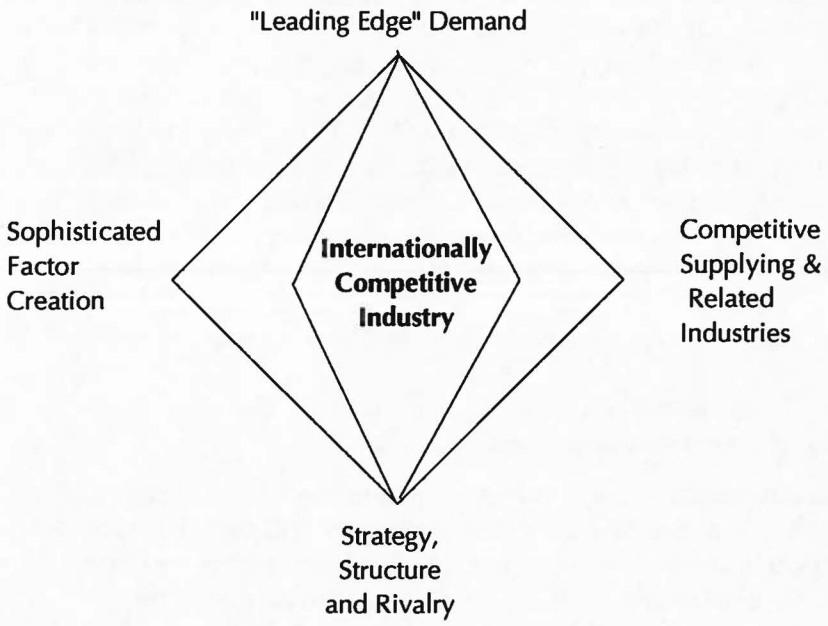
In asking why this pattern occurs, Porter (1990b) identifies four elements of the environment that tend to nurture champions:

1. **Factor Conditions** — Factor conditions include the society's natural resources and created factors such as infrastructure and skilled labour. Most important to sustained advantage here is to develop highly advanced pools of skills, technology and infrastructure tailored to specialized industries.

2. **Demand Conditions** — Demanding and sophisticated local buyers pressure firms to innovate, and if their needs anticipate those likely to emerge in other countries, then they will tend to spur firms on to international competitiveness. Government can exert a similar influence through either the establishment of leading edge regulations for product safety, quality and environmental performance or by demanding high performance standards for procurement.
3. **Related and Supporting Industries** — Innovative capability is enhanced when local suppliers of specialized machinery, components and services are themselves world-class innovators. These suppliers are important sources of technology, ideas and skilled employees. Suppliers and end-users clustered in the same geographic region can also reap benefits from a quick and constant flow of ideas and innovations. World class companies in other industries related by technology, skills or customers are also excellent sources of innovative relationships.
4. **Firm Strategy, Structure and Rivalry** — Local conditions and legal frameworks governing how firms are created, organized and managed, together with the nature of domestic rivalry, are important factors in determining how firms invest, innovate and compete. The ease of establishing start-ups and cultural attitudes toward risk also affect the growth and innovativeness of particular industries. The goals and pay-back periods of investors affect the availability of capital for long-term investment. The cultural esteem attached to an industry will affect the quality of human resources attracted to it and the persistence with which they compete. And most importantly, intense rivalry between several local competitors is perhaps the greatest driver of innovation.

"Intense rivalry between several local competitors is perhaps the greatest driver of innovation."

Figure 2. The Competitive Diamond



According to Porter, these elements work together in a self-reinforcing system called a "diamond". Weakness in one or more of the elements will limit the benefits derived from the others. The way government and chance events affect competitiveness can be understood by how they affect elements of the diamond.

If the elements of the diamond determine long-term competitiveness, then it follows that individual firms should not only be benchmarking their products, processes and strategies against the best competitors in the world, but should also be benchmarking the health of their local competitive diamonds against global competitors. To accomplish this, firms have a large stake in cooperating with others in their industry — local suppliers, governments, post-secondary institutions, research organizations, trade associations, even competitors — in order to actively strengthen the foundations upon which the innovative capability of the local industry rests.

It is time to see how networking can affect this competitive diamond:

Factor Creation

Network cooperation can help the diamond in many ways. To begin with, building the kind of industry-specific and highly specialized factors (skilled labour, research programs, specialized equipment and services, etc.) needed for long-term competitiveness is beyond the capabilities of individual small firms. They generally do not have the money to invest in, nor the clout to lobby for, the services they need.

"In Alberta, a small manufacturer may have over 40 government programs he is eligible for."

Reliance on government agencies or universities to determine and provide a coherent approach to servicing particular industries or industry segments is a false hope. Public programs are functionally specific and atomized in their structure, with little effective coordination between them. In Alberta, a small manufacturer may have over 40 functionally-specific programs he is eligible for, offered by the provincial and federal governments, the Alberta Research Council, local development groups, and educational institutions, not to mention the private sector. Few are specialized according to industry, and even fewer understand his situation in a wholistic fashion.

In order to make services more focused and effective, private companies must band together to negotiate for services tailored to their industries, strategies and needs. Organized networks, with clear strategies and common needs, are the most effective agents of demand for tailored public services. Better still, they are well-suited to work in partnership with outside institutions to provide seamless services tailored to their member's needs. The most competitive European SME sectors have very strong factor-creating networks.

Sophisticated Demand

Porter's diamond model states that highly sophisticated customers are an important driver of local innovation. Networks that share global marketing intelligence, make clear the requirements of the most lucrative customers, and make it possible for small firms to go after these customers, can offer an excellent potential link with "lead users."

Supporting Industries

Networks have a strong impact on the development of related and supporting industries as well. Because of the increased awareness of market opportunities and

the ongoing assessments of network competitiveness that networks provide, they tend to generate new enterprises that enrich the capabilities of the members. Entrepreneurially-minded people from the industry see the need for better supplies, components or related services and find a worthwhile environment to launch new companies. This phenomena is particularly strong in northern Italy.

Production networks might also prove attractive enough as customers to form partnerships with larger companies having the capabilities they are short on (again, witness the Danish Aids for the Disabled network).

Strategy, Sturcture, Rivalry

Networking has the potential to stimulate more strategic thinking among small firms, primarily by making previously unavailable information and skills accessible. It can also drive the incorporation of high value-added specialization strategies in ways discussed earlier.

These effects are positive. However, the critical question is: "What effect will production networks in particular have on local competition?" When considering the promotion of production networks, it is important to be clear about the role of domestic competition in sustaining international competitive advantage. Porter's ideas offer strategic insight into this phenomenon.

In today's world, the rate of improvement and innovation generated by firms is much more important than static cost or locational advantages. In The *Competitive Advantage of Nations* (1990b), Porter had this to say:

"In global competition, successful firms compete vigorously at home and pressure each other to improve and innovate."

> Among the strongest empirical findings from our research is the association between vigorous domestic rivalry and the creation and persistence of competitive advantage in an industry. It is often argued that domestic competition is wasteful, because it leads to duplication of effort and prevents firms from gaining economies of scale.... In global competition, successful firms compete vigorously at home and pressure each other to improve and innovate. Additional scale is obtained by selling worldwide.

Porter's reasons for this phenomenon are worth elaborating on:

> Rivalry among firms from the same home base is particularly beneficial for a variety of reasons. First, strong domestic competitors create particularly strong pressures on each other to improve. One domestic rival's success signals or proves to others that advancement is possible. Rivalry among domestic firms often goes beyond the purely economic and can become emotional and even personal. Pride drives managers and workers to be highly sensitive to other companies in the nation.... Domestic rivals fight not only for market share but for people, technical breakthroughs, and more generally, "bragging rights." Foreign rivals, in contrast, tend to be viewed more analytically. Their role in signaling or prodding domestic firms is less effective, because their success is more distant and is often attributed to "unfair advantages." With domestic rivals, there are no excuses... (Porter, 1990b, p.118-20)

Because firms in the same locale face similar cost conditions, the direction of their competition tends to be toward innovation. Local rivals must look to other differentiating factors and explore diverse strategies in order to achieve an edge. In the long run, firms themselves have a stake in healthy local rivals; Porter's study

revealed few examples of internationally competitive firms that were not strengthened by healthy local rivalries. Thus, any form of network cooperation that dampens innovative rivalry is probably bad strategy over the long term.

Not All Networks Are Created Equal

In the context of Porter's diamond model, the distinctions between different kinds of networks become essential. First of all, international competitiveness is extremely difficult to achieve without highly industry-specific factors of production, in particular, skilled workers and research assistance. A fundamental priority of small firms then should be to achieve reasonable access to these resources and to ensure that they are continuously being upgraded. Factor creating networking is therefore a first priority. It should be pursued through existing broadly-based organizations like trade associations if possible, or by new organizations that gain wide industry participation.

Factor-creating networking is a very distinct activity from trying to build production networks — entities that are best nurtured (at least in their initial stages) by limited memberships.

If production networks do arise, the way cooperation is structured becomes crucial. In the long run, the most successful production networks will be those that achieve a virtuous balance between cooperation and competition. The trick is to maintain a competitive dynamic within networks.

Methods for accomplishing this difficult balancing act are available in both stable and dynamic network situations. Where partners have developed close, long-term relationships with each other (i.e., where the network is relatively stable), it is important that the price and quality of each member's products continue to be tested in the wider market if the network itself is to maintain competitive fitness and an innovative edge (Saxenian, 1990; Miles & Snow, 1992). Firms that compete in the wider marketplace develop their adaptive skills by serving various clients and come into contact with ideas for innovative products or service enhancements. These ideas in turn are the basis for the network's competitiveness.

"The trick is to maintain a competitive dynamic within networks."

For individual firms, it is essential to maintain autonomy and exposure to a variety of markets and not become overly dependent on the network for their livelihood. Overdependence can occur by simply growing lax in pursuit of alternative markets, by entering into entangling long-term contracts that make exit difficult, or by "over-customizing" production facilities to the network's unique needs (Miles & Snow, 1992). Avoiding this situation means:

a) setting explicit limits on the production directed to any one customer or the proportion of assets invested in any customer's unique requirements. (20% - 30% is a common range — see Saxenian, 1990), and
b) working through simple, flexible contracts that leave participants free to withdraw or source innovative new inputs from firms outside the network.

Beneficial network relationships also require thinking strategically about the individual firm's position in the wider market place in terms of specialization. While specialization is essential to the focus strategies described in this paper, basing a firm's strategy too heavily on particular network ties can lead to an overly narrow focus. Networking efforts are often based on developing and exploiting "mutual complementarity" (Nielsen, 1992), a process that leads to healthy specialization, but if taken too far, can lead to over-specialization in the cause over reducing overlap and competition. According to Miles and Snow, good strategy

requires that firms "occupy a wide enough segment on the value chain to be able to test and protect the value of their contribution" (Miles & Snow, 1992). It should be incumbent on individual firms in the network to create and maintain a "clear competence-based position on the value-chain" and to "continually reappraise their technical competence and the scope of their activities" in order to protect themselves and take full advantage of their emerging skills (Miles & Snow, 1992).

Italy's dynamic networks seem to accomplish the balance between competition and cooperation best. Network hubs work to upgrade the capabilities, skills, technology and access to markets for all members (they are factor-creating); but production networks form and dissolve spontaneously from among the membership as market opportunities arise (see the example of the textile industry in Emilia-Romagna). Network norms reward the best innovators but prevent destructive forms of competition. The dynamics of competition encourage increasing focus and specialization over time as firms use innovation to seek unique positioning within the most lucrative ventures. The memberships of these ventures are not static but change over time.

Competitiveness in Networks

With these considerations in mind, both factor-creating networks and production networks can help build and enhance strong local competitive diamonds. They can put small firms on a new competitive footing. Factor-creating networks provide access to all the tools their members need to compete. Production networks can be an extremely competitive way to tackle the global market, even in direct competition with giant global firms.

"Network norms should reward the best innovators but prevent destructive forms of competition."

The reasons for the competitiveness of production networks include the following.

a) The structure of production networks can greatly facilitate the process of specialization. Firms built around certain specializations will achieve more focus, and probably higher rates of innovation, than similar units subsumed in a large organization.

b) If competitive gaps are found, dynamic networks tend to fill them. Because of the increased market opportunities and clear ongoing assessments of network competitiveness, networks tend to stimulate the creation of new enterprises that enrich the capabilities of the existing group. Networks thus tend to grow because they offer a tremendous climate for "blue-collar entrepreneurship." In the process, they make the industry as a whole a more appealing place for talented individuals to establish careers.

c) When they take a dynamic form, production networks can reshape themselves to meet changing market demands almost instantaneously without the internal decision-making and approval apparatuses that exist in large firms. Their potential for hyper-sensitivity to end-customers is a powerful competitive advantage in today's rapidly changing international marketplace.

The participating firms within networks also become very competitive. Individual participants can focus on a narrower specialization and reasonably strive to be the best; they have their eyes set on world markets and world class standards for quality and innovation; they can seek out opportunities and capabilities that otherwise would be outside their reach; and they can be part of more influential marketing and bargaining units. One Danish network coordinator had this to say about the promise of networking for existing small companies:

> Networks allow individual small companies to compete successfully with the best of large firms. The key factor motivating Danish network participants was not the wish to grow — most prefer to remain small — it was the wish to survive. Very similar problems exist in North America — the crisis of competition that is upon small business is international in scope. Through manufacturing networks, we see a rekindling of the dream that drives many small businesses. The strategy allows business owners to stop thinking only in terms of limitations. They say, "Who will I have to work with in order to pursue this opportunity?" (Nielsen, 1992)

Learning and Innovation

Possibly the most important benefit of networking is that it can create a dynamic learning environment. This is true in wide "factor-creating" networks, and can accelerate amongst firms that collaborate more closely in production or marketing.

Mutual learning does not happen because firms share their innovations explicitly with other firms. First of all, firms in networks find it difficult to plan for innovations; they usually pursue joint work in areas where tangible, short term benefits can be anticipated. Secondly, individual firms understandably consider their innovations to be their key distinguishing feature — their competitive edge. There are exceptions to this rule; for instance, where a process innovation is already common knowledge and firms want to adopt it more quickly and economically, or where developing a new product requires the collective expertise of firms. Generally though, things recognized as innovations are considered proprietary knowledge (Bosworth & Rosenfeld, 1992, p.38).

"Possibly the most important benefit of networking is that it can create a dynamic learning environment."

Learning and innovation do, however, occur in networks, but they occur as spinoffs — firms indirectly learn from each other while collaborating for other purposes. In northern Italy, one network broker explained:

> ...the existence of networks with person-to-person contacts is essential for the high level of creativity in the region. Innovations in the networked SMEs surface as incremental improvements in products and processes, stimulated by the knowledge gained from casual conversations with peers, customers, suppliers, vendors, and even competitors, as well as individual responses to joint study tours, plant visits and expert presentations. Because the changes can seem minor until aggregated, they often are not even recognized and classified by firms as innovations. (Bosworth & Rosenfeld, 1992, p.30)

Shared participation in jointly sponsored management seminars, training programs and multipartner task forces are good ways to facilitate mutual learning. In fact, building social contacts between a region's firms through these type of events may be the best way to start networking efforts.

Mutual learning is also facilitated by the flow of direct communications and assistance between suppliers and customers. Good suppliers by their very nature focus on helping customers solve problems. Industrial customers also have a strong interest in working closely with their components suppliers to ensure quality and compatibility with the end-product. For these reasons, firms may lend engineers and management personnel to help each other improve their products and operations. This kind of vertical cooperation is a strong feature of kingdoms (i.e.,

networks dominated by large firms)and is becoming more prevalent due to the "lean production" philosophies taking hold in large companies. However, vertical cooperation also happens within republics (production networks) as long as the partners are not direct competitors in other markets.

Networks that build a viable industry in their locales eventually achieve a subtle but powerful learning dynamic. "The city or region becomes a unique environment for competing in the industry. The information flow, visibility and mutual reinforcement within such a locale give meaning to Alfred Marshall's insightful observation that in some places an industry is 'in the air'." (Porter, 1990b, p.156)

"In some places an industry is 'in the air'."

In short then, it is important to not view networks superficially, as just another pet government program or superficial business fad. Just getting a group of firms together to share some expenses will not create a dynamic and internationally competitive industry. Eliminating duplication and "rationalizing" industries is not the point either. Networking must be seen as a dynamic concept — an attitude and a way of doing business — not just an organizational form. A networking mindset is one which can accommodate the paradox of competing vigorously with someone on one level while simultaneously cooperating in ways that serve the common good. It is a strategic orientation, one in which small companies work together to raise their competitiveness and unearth opportunities for the group, while competing innovatively to secure maximum benefits for themselves.

Section III:

Building Networks

Networking: Many Options

"We need definitions and differentiations of (the word) 'network', much as Eskimos need 54 different words for 'snow'."

(Niels Christian Nielsen, in Bosworth & Rosenfeld, 1992, p.21)

For clarification purposes, we have made the following distinctions:

a) between factor-creating networks (with wide industry membership) and production networks (assumed to include smaller subgroups); and
b) between static and dynamic production networks.

In looking at how networks take shape, we will continue to structure the analysis around these distinctions. But as indicated above by Nielsen, this neat categorization does not capture the rich variety of networking forms. Factor-creating networks might take the form of rejuvenated trade associations, or if existing associations are unable or unwilling to take the lead, they might take the form of narrower groups of like-minded firms, possibly clustered in close geographic proximity, working with local institutions. In fact, factor creation might involve a number of industry groups with overlapping mandates and jurisdictions, as is common in Europe (chambers of commerce, national/regional industry associations, segment-specific sub-associations, regionally-organized service centres, etc.)

"In some cases, the public-private partnership is so close that it is hard to distinguish where the public program ends and private activities begin."

Factor-creating networks will almost always involve some level of partnership with government, and this level of coordination will vary. In some cases, the partnership is so close that it is hard to distinguish where the public program ends and private activities begin.

Factor-creating networks may be involved in the promotion of joint production and marketing networks. Production networks might in turn be involved in factor-creation, complementing the mechanisms in place or attempting to make up for their absence. Production networks might start out with static boundaries and grow more dynamic over time (the Danish experience). Or highly fluid and informal arrangements might evolve naturally out of in-depth factor-creating cooperation (as in Italy). Production networks may or may not need separate service centres, several types of brokers may be involved, and the range of activities they undertake can vary considerably.

With these considerations in mind, we willl look at how networks come together.

Factor-Creating Networks

Though each form of networking offers potential benefits, it cannot be overemphasized that factor-creating networking is the most fundamentally important of the alternative forms. In spite of the current appeal of production networks, this is probably the most important lesson to learn from the European successes in SME sectors. If small firms don't have the requisite access to skills and information, they will not remain internationally competitive for any significant duration. Joint

production or marketing with other small firms that suffer the same deficiencies will not help much.

In North America, whole manufacturing industries have discovered their domestic markets threatened by foreign competition operating at higher levels of technological competence, innovativeness, quality, productivity or marketing sophistication. This shared dilemma happens often due to:

- decades of little or no significant foreign competition following the second world war,
- the tendency for local industry clusters to have comparable machinery and equipment, a common level of mechanization and technology utilization, and a narrow focus on the local market (Fossum, 1993),
- inferior local infrastructure (see Porter's competitive diamond above), and
- a history of government import protection and subsidies.

Whatever the cause, meeting this situation (or avoiding it in the first place) calls for aggressive cooperation through industry groups that have the ability and determination to:

- study the deficiencies in depth,
- set shared strategies to overcome them,
- organize shared investments in "pre-competitive" infrastructure, and
- negotiate effectively with government agencies, research institutes and educational institutions.

Effective services are organized either by industry sector or region, or sometimes by both (witness the service centres in Emilia-Romagna). Depending on the situation, it might entail working through industry associations, local chambers of commerce, newly-created organizations or some combination thereof. Much will depend on what can be achieved at the level of the trade associations or chambers of commerce. If these organizations cannot (or will not) offer them, then the competitiveness-building work may have to take place at the level of smaller, newer networks housed in network service centres.

"In North America, whole manufacturing industries have discovered their domestic markets threatened by foreign competition operating at higher levels of technological competence, innovativeness, quality, productivity or marketing sophistication."

Attributes of Success

The key attributes of successful factor-creating networks are:

a) a pro-active attitude on the part of members (including small companies), demonstrated by the willingness to invest time, effort and money in a strong association;
b) a shared understanding of the local industry's competitive situation, facilitated by accurate, widely-shared information on local conditions, international markets and competitors, and technological developments world-wide;
c) regular opportunities for informal social interaction and information-sharing among members, possibly stimulated by expert speakers and other social events;
d) in-depth and ongoing cooperation with universities, technical schools, research organizations and government agencies, including well-targeted financial support from government;
e) industry leadership in the design of all public programs relevant to the industry;

f) memberships that do not contain highly polarized interests (such as one or two larger members wanting to maintain the status quo in a local market at the expense of smaller rivals); and
g) cooperative activities that are managed independently and have precise charters, so that all participants have equal access to information and services.

"For small firms, access to environmental supports is vital."

For small firms, access to these environmental supports is vital. Owner-managers who understand this requirement must make every effort to make sure this infrastructure is built. Active participation in trade associations, chambers, or community development organizations is important in stimulating conversation, finding like-minded industry participants and shifting agendas toward competitiveness issues. Small cities or rural areas, or high geographical concentrations of firms in one industry, can have an advantage in this regard because communication lines are short. People have more opportunities to interact in tightly-knit communities.

Creating a Competitiveness Agenda

In factor-creating efforts, it is important to stimulate a constructive dialogue focused on building a common understanding of shared competitive challenges and what is required to overcome them. This is not easy to do. In trade associations, the old attitudes described earlier are often deeply entrenched. Static cost-based attitudes toward competition, and the resulting lobbying activities, predominate over a focus on infrastructure and innovation strategies. Sometimes existing trade association or chamber of commerce memberships are so wide in their scope that different conditions and needs prevail among the members; the association is polarized between competing camps and paralyzed in its ability to focus on creating specialized factors. Individual managers who understand the requirements of global competition have a strong interest in working to turn these conditions around, or in looking at establishing alternative groupings with different boundaries and a renewed focus on competitiveness.

Networks will become focused on constructive activities if they start by considering the following kinds of issues:

"Who are the best foreign competitors and how good are they in terms of quality, innovativeness, responsiveness, and cost? How fast are they improving?"

1. Are participating firms reaching the markets they need in order to succeed?
2. Are they satisfied with their ability to track changes in distant markets?
3. Who are the best foreign competitors and how good are they in terms of quality, innovativeness, responsiveness, and cost? Where do their competitive advantages lie? How fast are they improving?
4. How does the local industry generally rate along key dimensions relative to the best foreign competitors? Do participating firms share any technology or management practice deficiencies that hamper competitiveness?
5. Can the firms expect significant increases in foreign competition in their domestic market in the short-to-medium term?
6. Can participants develop new products?
7. Are they satisfied with their production technology?
8. Is the workforce skilled enough to compete on a higher level, to produce different products, to use new machinery?
9. Are participants satisfied with their capacity to understand and comply with environmental requirements?

10. Are they satisfied with their relationships with sources of input materials and local value-adding services (consulting, etc.)?
11. Are members satisfied with the their ability to negotiate satisfactory transport arrangements for goods being sent to foreign markets?
12. Could participants better compete if they worked together on the problems they identify?

Firms will not even be able to answer many of these questions. That itself is instructive and will point to the need for collective efforts to generate information. Independent studies should be commissioned on particular issues so that some base of consensus is gained on what needs to be accomplished.

Factor-Creating Acitivities: A Closer Look

As consensus and the taste for mutually beneficial cooperation build, the activities that strong factor-creating networks can undertake includes the following.

Public Sector Cooperation

Effective factor creation almost always blurs the lines between the public and private sectors. The European factor-creating mechanisms described earlier are very effective because public money is channeled through private-sector organizations close to the needs of their members. When SMEs speak collectively through their organizations, they help target public development money to their needs through a dual focus on industry sector and region. Public sector business assistance spending is rarely cost-effective unless channeled in this way. Alternatively, for SMEs, world-class factor creation is almost impossible to achieve without active public-sector involvement.

Once industry-groups have a clear consensus on pursuing active factor-creation, they can then begin acting as a sophisticated influence in fashioning training/apprenticeship programs, university research agendas, export assistance programs and physical infrastructure in conjunction with public institutions. Many of the activities below will require active public-sector support, and may even be centred in public institutions (such as community colleges). This point is important because very few of the successful factor-creating services in Europe (service centres, for instance) have become self-funding.

"Up-to-date, industry-specific information on international opportunities, competition and market trends is essential to shifting the perspective of small firms away from their dangerous myopic focus on the domestic market."

Labour Force and Management Training

Networks can identify common needs for labour force training, and either provide it at a central location, arrange for local institutions to provide it, or some combination of both. Subjects might include statistical process control or proficiency in new process technologies, for example. Networks can also provide general management information and education on such areas as marketing, financial management and world-class manufacturing methods, presented through seminars, workshops and guest lectures.

Most importantly though, networks have an active partnership role to play with technical schools in developing tailored apprenticeship programs for their sectors. European trade associations are very strong in their support and involvement in training, including many in-depth apprenticeships that begin in the public schools at age sixteen and progress for several years. A few states in the U.S., notably Arkansas, are beginning to adopt this approach (Rosenfeld etal, 1992).

International Market Intelligence

One of the most important activities for industry networks to undertake is analysis of the international marketplace. Up-to-date, industry-specific information on international opportunities, competition and market trends is essential to shifting the perspective of small firms away from their dangerous myopic focus on the domestic market. The establishment of a sophisticated information-gathering structure and its wide publicity within the industry motivates firms to build internationally competitive operations and pursue high value-added international niche strategies.

The service centres SVEX and RESFOR in Italy are excellent examples of creative approaches to making useful information available to small firms. The chambers of commerce in Germany are also extremely effective in this regard. In Britain, pressure from industry resulted in the British Board of Trade creating subsidies for in-depth, targeted market research for small firms (Nothdurft, 1992). No matter what the approach, good international market information should be considered a basic infrastructure issue, something small firms have a critical interest in.

Technological Scouting

Technological scouting is closely tied to international marketing intelligence. Industry networks can send missions to investigate new process technologies, bring in experts to talk to members about their potential and organize demonstrations. They can also support industry-specific research at local institutions and promote its diffusion among members.

Sharing of High Cost, High Technology Equipment

Some networks organize joint investments in proven, but not yet locally used, process technology. Usually housed in a central service or "technology centre," time on the equipment is rented out so that network members can turn out higher precision products, build the skills and sophistication of their employees, and possibly make informed investments of their own as a result. CITER's database in Modena, Italy is a good example. In the U.S., several states have worked with local groups to establish technology demonstration centres, some housed in technical colleges and others in mobile units (that is, set up in the back of trucks) so that rural firms can access them (Rosenfeld etal, 1992).

Joint Benchmarking, Analysis and Productivity Enhancement

Networks can prepare assessments of the management, process technology, quality control and marketing needs of individual firms. The assessments can identify productivity problems within the industry and provide strategies for improving competitiveness. Confidential reports can be provided to each firm. The reports analyze individual company performance in the areas of productivity, quality, and return on assets against benchmarks in the industry — both domestically and internationally. Tailored recommendations flow from these assessments.

Sectoral Quality Assurance

Network resources can be directed toward establishing industry standards, procedures, systems and tools to improve overall quality throughout the industry.

Special joint efforts would be directed at solving industry-wide technical problems, or assisting members in meeting certification standards like ISO 9000 which are becoming critical to selling in demanding markets. (For small companies, the cost of meeting ISO 9000 standards can be prohibitive. The Canadian Manufacturers' Association is taking a lead role in supporting companies to achieve certification, but more collective efforts will be required at the local level.)

Consulting Assistance

The industry can certify specialized consultants for use by member firms and put the two sides in contact when needs arise.

Front Office Systems

Some European networks centralize essential front office services in local service centres. The centres provide tax accounting help, legal and regulatory advice, and insurance procurement. They might also assist firms with cost accounting and help them adopt cost-effective management information systems and micro-computer technology. For small firms, front office assistance can reduce the time and cost burden of basic administrative processes, especially those that involve government red-tape. In the process, they allow firms to focus their efforts on customers, products, processes, and technology.

Electronic Communication Infrastructure

In Italy, service centres have encouraged the installation of standardized computer systems that link members together. This electronic communication provides access to common databases and bulletin boards of industry information, and is used to organize "spot market" bids for new market opportunities that members need help in fulfilling.

Industry Publicity

Trade associations or other hubs might undertake to promote the domestic industry as a whole in international markets — to identify the region with quality. This advertising work would be considered pre-marketing for the companies or production networks that follow. The hub might also publish and circulate catalogues detailing machining capabilities or goods produced, and sponsor trade shows.

These cooperative activities will go a long way toward making the firms within an industry competitive and internationally focused. Notice that they in no way curtail domestic competition — they raise it to a higher level and tend to direct it toward innovation. They also act as the basic foundation for more intensive forms of cooperation.

Factor-building cooperation is fundamental to building and sustaining a strong competitive diamond in the local environment, and all firms (especially the smallest ones) have a strategic interest in making sure this cooperative infrastructure is in place. Public assistance will also be much more effective if it is demand-driven by industry groups appropriately focused on a true competitiveness agenda. The regions in Europe where small manufacturers are thriving have built these kind of institutions; North American efforts have a long way to go to catch up.

Production Networks

Production networks are usually the brainchild of an enterprising company that sees an opportunity to serve a new market that is beyond its capabilities to meet alone. Working with other firms possessing complementary skills and equipment brings new opportunities within reach. There are a number of directions that offer the potential for profitable partnerships.

Vertical Supply Chain

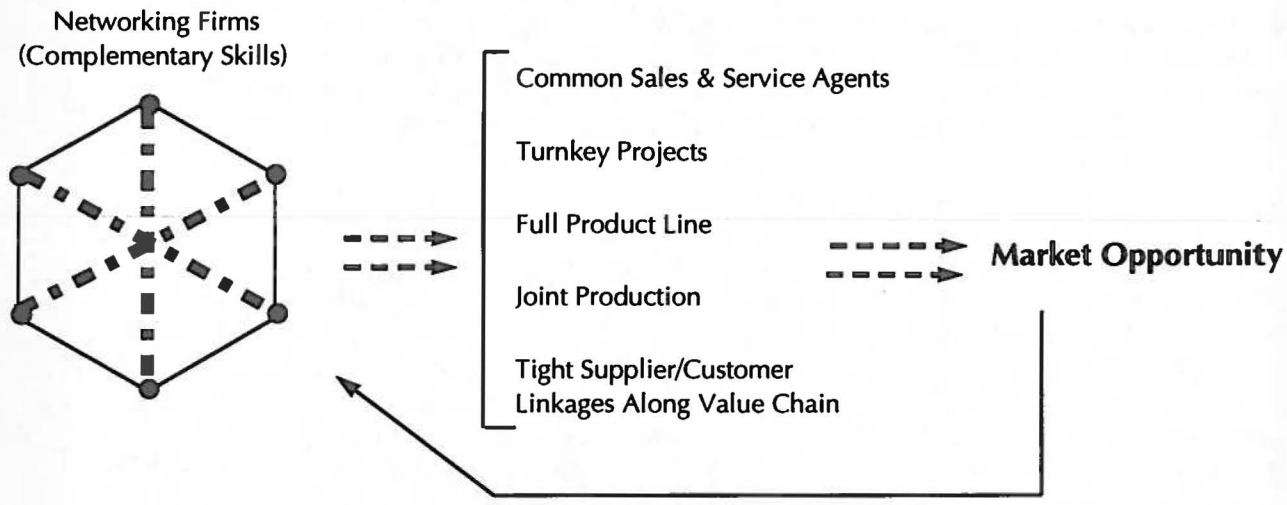
Firms at different value-added positions on common supply chains have many opportunities to work together to develop new capabilities and build mutual competitive advantage. This might take the form of sharing strategic information, solving joint production problems together, working together on product development, setting up electronic links and "just-in-time" delivery arrangements, and so forth.

In the 1980s, large companies the world over began a revolution in their thinking about how to work with suppliers. From the Japanese, they are learning that working in close relationships can:

a. reduce production quality problems;
b. shrink inventory carrying costs; and
c. enhance product development by nurturing the growth of design skills in specialized suppliers, bringing them into the design process at an early stage, and collapsing development cycles.

These type of arrangements are not the exclusive province of large companies however. Smaller companies in supplier/customer relationships can achieve the same benefits working together.

Figure 3. Production Network Opportunities



(The more volatile the market, the more flexible the network arrangements must be.)

New Products, Product Lines or Turnkey Projects

It may be possible to work with numerous other firms to package and market products in new ways. Networks with complementary skills can dedicate themselves to developing, prototyping, producing or commercializing new products, techniques or processes. Other firms may specialize in different stages of production and marketing of goods. Working together, complex new products can be produced and marketed to the benefit of each partner. Together, they can break free of dependent roles as captive subcontractors to large firms.

Production networks can also make use of joint negotiating and purchasing power to procure raw materials, services and capital at lower costs. Together, they might find a mutual supplier for important components, as the Danish Aids for the Disabled network did with their electronics supplier. Or they might be able to lock in a long-term contract to supply a larger firm with a component or subassembly. Or they might establish common sales agents in key markets.

If these new opportunities come to represent a large enough portion of overall business, then it will encourage individual network members to focus more efforts on cooperative work and develop narrower specializations. By expanding their geographic reach and working to crack lucrative (and thus highly competitive) markets together, each partner becomes less dependent on the domestic market. The previously-described focus strategy (i.e., specialize in skills and technology, expand geographically) becomes necessary and appealing. Firms see the role of specialization in competing with the world's best; a coordinated approach to specialization increases the rewards and lowers the risks.

This is perhaps the most creative form of networking, one that requires visionary leadership and intimate market knowledge. Dynamic Italian industries have been built on this model, and the same seems to be happening in Denmark. When it works, the result is a situation in which "1+1+1 = 4".

Large Contracts, Distant Markets

Often individual local companies in closely related (or even competing) activities will each be limited in their ability to fulfill large contracts and/or penetrate distant markets. Working together, they can focus on opening new markets for existing products that would not be accessible without cooperation. This means strict delineation of cooperation to new markets; firms may well be continuing previous competition in existing markets.

These three avenues of cooperation may overlap in areas where joint work is common. In environments like Europe's industrial zones, small firms may be simultaneously involved in more than one cooperative venture. As implied in our distinction between static and dynamic networking, the arrangements can form a spectrum from temporary to relatively stable.

Trust is the biggest issue to be faced in building production networks. In North America, production networking challenges many precepts of our business culture. While we will leave detailed discussion of attitudinal barriers until further on, building trust ultimately requires that clear understandings be negotiated that clarify the areas of cooperation versus competition between participating firms. Will these networks have stable memberships, or will they be temporary agreements in which new partnership arrangements form as conditions change? What kind of contracts will prevail? What areas will they cooperate in? How will the rewards be distributed and people be paid? These are all tricky issues.

In environments like Alberta, where firms have more to learn about cooperation than competition, and where industry clusters are rather thin and widely dispersed, initial network efforts will probably have static borders. Relatively stable internal structures can help firms build trust, understanding and a taste for cooperative work. However, it will be important in the long-run to consider how to institutionalize innovative competition and increase flexibility to insure maximum competitiveness.

Production Network Brokers

Like the word network, *broker* has come to mean many different things, with many actors taking on roles that wear this label. Distinct roles include the following.

a) Lead firms — enterprising small companies who see market opportunities that require partnerships with other small firms in order to exploit;
b) "Scouts/Missionaries" — people from government agencies or trade associations who are sold on the idea of production networks and promote the concept to a wide audience of small companies;
c) Facilitators — impartial process champions who identify potential participants, sell them on the idea, moderate meetings, structure deals, lobby and negotiate for outside assistance, resolve disputes and build trust. Their role is meant to be a temporary one. In the absence of "lead firms," the broker will also play the role of identifying initial market opportunities for potential networks.

"Like the word network, broker has come to mean many different things."

In Germany and Italy, these last two roles are largely embedded in the role of trade associations or regional industry service centres, to the degree that they are needed at all. Cooperative arrangements are such a part of the business culture that lead firms (like the impannatore in Italy) need to rely very little on outside facilitators. However, in environments where production networking is foreign to the business culture, it is important to distinguish these roles and formalize them to a certain extent.

The Danes were probably pioneers in using impartial facilitators, and it is this role they mean when they speak the word broker. Facilitating brokers are a major feature of the Danish model of networking, and it is the Danish model that is presently attracting intense interest and imitation in North America. The originators of the Danish program included in their efforts the creation of a formal broker training program at the Danish Technological Institute. People from all over the world have been trained in Denmark, and similar programs have been established at locations in Britain and the United States.

In Canada, two "missionary" organizations are planning to develop training for facilitators. The Canadian Business Network Foundation (sponsored by the Canadian Manufacturers' Association) has recently put some officials through the Danish training, and these people are now working on pilot projects in Ontario to demonstrate the feasibility of production networks in Canada. If they are successful and attract government financial support, new brokers will be trained in the provinces that wish to promote the Danish model.

The Canadian Institute for Business Networking (CIBN) was recently established to build on the experiences of successfully managing business networks in the Ottawa-Carleton area. CIBN completed a study on the characteristics of successful facilitators and is developing a training course with specific Canadian content. (More on these Canadian organizations further on).

Service Centres

In regions without strong factor-creating institutions for helping small firms, production networks will be operating without the base of outside support featured in Europe. As in the United States, problems of basic competitiveness (due to relatively low managerial and technological sophistication, deficiencies in labour skills, etc.) will be a serious constraint on their success, and production networks will find themselves doubling as factor-creating institutions.

These situations will call for firms seriously interested in long-term cooperation to establish a common service centre. However, even where outside support is already strong, service centres can serve to meet the specialized needs of particular ventures. A separate centre will house a small number of permanent staff to administer the plans and programs of the network. Run by the broker, the service centre will be responsible for:

- Institutionalizing ongoing communication among and between firms, and with outside entities such as specialists, designers, equipment-makers, and customers;
- Performing the research needed, whether on new technology or international markets, in order to identify threats and opportunities for the network;
- Utilizing what is learned about competitive barriers to organize the crucial service or services, whether through private consultants or public institutions, that participating firms need;
- Performing shared front office functions;
- Actively housing and managing collective investments made by the network in such things as training resources, international market databases, and possibly advanced manufacturing machinery.

Like everything else about networks, there are no firm rules about when separate service centres should be established, what services they should provide, or how they should be funded. In Italy, for instance, trade associations run service centres distinct from the production networks that form around them. Much will depend on the strength and orientation of the trade association, whether it serves the relevant segment or geographical area well, or whether other entities are providing some of these services (for instance, community development centres).

"Though on the surface, most owner-managers would agree networking is a sensible idea, attitudinal barriers remain, many of them below the level of conscious thought."

Obstacles to Cooperation

Small companies approached about active participation in either factor-creating or production networks are not easily convinced to invest the time, effort and resources required to make it work. The kind of cooperation involved in networking challenges several fundamental assumptions that most North American manufacturers have shared for generations. Though on the surface, most owner-managers would agree networking is a sensible idea, attitudinal barriers remain, many of them below the level of conscious thought. In the face of hectic day-to-day concerns, it is very difficult to step outside of the fray, and to identify and suspend deeply-held implicit assumptions about how business is conducted — especially when those assumptions are embedded in the business culture.

To generate enthusiasm for networking then, the place to start is to bring to light and confront implicit assumptions we bring to the world of business. Peter

Senge (1990) calls this type of personal work "surfacing mental models." What follows are some of the deeply held, yet often unconscious and unquestioned assumptions that could act as barriers to network opportunities.

Too Little Money, Too Little Time

"To talk of grand strategies and global ambitions seems an ethereal exercise removed from daily reality."

We raise this concern first because in the daily reality of small firms, it is the most prevalent concern. Owner-managers of small manufacturing firms generally wear many hats and must scramble much of the time to keep their businesses afloat. To talk of grand strategies and global ambitions seems an ethereal exercise removed from daily reality. The time spent to get together and talk may itself seem a waste of valuable time.

The solutions to this problem lie in a number of areas. One of them is geographic concentration of networking partners. Another is the brokers' persistence and ability. A broker who focuses on critical needs, and meets them with collective efforts providing short-term payback, not only builds trust but may also free up owner-managers from some of the concerns that are creating the scramble mentality. Shared investments save money, cut down on problems caused by lack of expertise, and thus free up time. This is one reason why shared investments in front office skills has been such a popular initial activity in fledgling networks.

In the long run, firm managers want to leverage their time to the greatest degree possible. Within their firms, adopting "world-class manufacturing" practices can make internal business processes more self-managing, thus allowing managers to shift attention to strategic issues. To the degree that networks support such internal changes, they help members step above the fray. Beyond this, the rewards of networking — improved competitiveness, access to new markets, enhanced market reputation through increased specialization — make networking worth the effort.

No Economic Imperative

Perhaps the greatest difference between European and Asian SMEs, and those in North America, is that overseas firms have generally seen themselves as competing internationally for quite some time. The focus for North American firms has traditionally been on the local, or maybe North American, market. This is changing slowly, but for many, it is still the case.

As we have seen, the changing world of business is making this parochialism a dangerous thing. The globalization of markets, with rapid technological change, promises impending doom to manufacturers that lack the global perspective and technological depth to compete effectively.

"Recognizing and dealing with changing circumstances is not easy."

Recognizing and dealing with changing circumstances is not easy however — especially when the local environment seems to be changing only gradually. This phenomena has been recognized by many psychologists and business writers. For example:

> Maladaption to gradually building threats to survival is so pervasive in systems studies of corporate failure that it has given rise to the parable of the "boiled frog." If you place a frog in a pot of boiling water, it will immediately try to scramble out. But if you place the frog in room temperature water, and don't scare him, he'll stay put. Now, if a pot sits on a heat source, and if you gradually turn up the temperature, something very interesting happens. As the temperature rises from 70 to 80

> degree F., the frog will do nothing. In fact, he will show every sign of enjoying himself. As the temperature gradually increases, the frog will become groggier and groggier, until he is unable to climb out of the pot. Though there is nothing restraining him, the frog will sit there and boil. Why? Because the frog's internal apparatus for sensing threats to survival is geared to sudden changes in his environment, not to slow gradual changes. (Senge, 1990, p.22)

This "slow boil" has been prominent in the decline of the American consumer electronics and automobile industries in the face of the Japanese. Witness IBM in the face of the microcomputer revolution, or Dome Petroleum's overexpansion and growing exposure to the risks of a drop in oil prices. The boiled frog analogy explains the fate of many humbled or deceased giants, but it is not a large-company phenomenon alone. Small companies compete in the same world and have fewer resources to weather severe competitive threats. While they may be quicker to adapt, they also have less intelligence-gathering resources to see changes coming.

"Small companies have fewer resources to weather severe competitive threats. While they may be quicker to adapt, they also have less intelligence-gathering resources to see changes coming."

Small companies in manufacturing industries have to look at the global trends that affect their industry. Are there international competitors in the local market? If so, where are they from? How is their performance fulfilling needs important to customers, and how fast are they improving? What are the technological trends in the industry? What actions will have to be taken to be competitive in ten years? These are not easy questions to address or answer given the hectic pace of day-to-day concerns. Possibly one of the best ways to get networking going is to investigate these questions, put the resources in place to get the answers, and publicize the results as widely and often as possible. A shared understanding of real competitive concerns is the most basic motivator for modernization and networking efforts.

Competitors as Enemy

One of the primary aims of small manufacturers is to be fiercely competitive on the local scene. This stance, though a healthy one in many ways, makes it difficult to contemplate cooperating at any level with existing or potential competitors.

The key here again is a strategic shift, from a strictly local perspective to a longer-term global perspective. When competition is global, a firm's dependence on its local environment becomes clear. Small firms that want to succeed with the specialization, high value-added strategies required will need access to skills, technology and information that come more easily in networks.

"Owner-managers in some of the most successful networking efforts describe themselves in the same way as North American entrepreneurs do — as fiercely individualistic and competitive."

It is interesting to note that owner-managers in some of the most successful networking efforts, in Italy for instance, describe themselves in the same way as North American entrepreneurs do — as fiercely individualistic and competitive. It is just the nature of the competition that is different. Italy's entrepreneurs want to be competitive in global markets. To accomplish this, they need the information and support that factor-creating networks provide. They also vie for positions in the best production networks for as long as they are profitable. They build their businesses by keeping their eyes out for new network ties that will enable them to enter new markets or increase margins (Hatch, 1988, p.12).

Adversarial Buyer-Seller Relationships

The North American norm in dealings between suppliers and customers has been to maintain arms length, adversarial, one-transaction-at-time relationships.

The preoccupation has traditionally been with minimizing input costs, and the route has been to go with the lowest price in the moment. What the Japanese realized first (and many North American companies are realizing now) is that there are plenty of hidden costs to this arrangement: problems with quality (and all the resulting scrap, rework, and firefighting), delivery unreliability, lack of coordination, high inventory carrying costs resulting from the need for safety buffers, and so forth. They have also realized that the quality of product designs, as well as product development times, can be greatly improved when major suppliers are included in the development process early.

For manufacturers that have not figured this out yet, its time that the case for closer coordination was made.

Loss of Ownership and Control

One fear that is often expressed by small firm owners about production networks is that cooperation will result in take-overs. Experience in this regard is mixed — agglomeration has begun to happen in some Italian networks; Danish networks have seen very little of it (Howard, 1990). Whether it is a factor to fear depends, in part, on the nature of the industry itself and on how the network relationships within it are structured.

It is important to remember that certain kinds of industries offer a strong competitive advantage to "flexible specialization" production (i.e., networks) over larger, vertically integrated companies. Industries with many small purchasers, and where the nature and size of contracts varies considerably, are ripe for networks that can put together high quality, customized products quickly. Firms that operate at different optimal scales of production, but where each of the components is needed in the end product (for instance, masons who build fireplaces working with home builders), is another structure where networks provide the needed flexibility. Firms in these networks have different patterns of slack time, in which they can pursue outside jobs independently (Illinois, 1992).

"Building the basic managerial and technological competitiveness of small firms should be the most important focus of networking efforts."

In these situations, cooperation is not likely to result in economic pressure to merge. When orders are consistent and large, however, or where production problems lend themselves to unified management, larger firms will have an advantage and there may be valid concerns about takeovers.

Key Success Factors

The distilled experience of successful networks in Europe and the United States point to a number of factors critical to their success.

Start with the Fundamentals

One of the strongest conclusions of this report is that building the basic managerial and technological competitiveness of small firms should be the most important focus of networking efforts. Factor-creation efforts should receive relatively high priority over the promotion of joint production and marketing unless the basic building blocks of competitiveness are already in place. Firms should be focusing on cooperation that brings together commonly accessible services and infrastructure support targeted to their specific industries. Tailored worker training

and apprenticeship programs; up-to-date, specific international market intelligence; technological scouting and performance benchmarking; shared investment in leading edge process technology; rosters of qualified, industry-savvy consultants: these are things that can be achieved when companies work together by sharing investments and tapping into local institutions.

The logic of factor-creation argues for cooperation that includes the widest groupings possible, as long as the members share common needs in these areas. Receiving the attention and support of local governments, educational institutions and other public agencies is part of making it work. The larger the group, the more attention it will receive.

Refocusing trade associations and chambers of commerce along more European lines would be an exciting direction for their membership (and would be an area worthy of further study). But firms do not have to give up if they feel powerless to generate participation within trade associations. Determined groups of like-minded small firms can do much in conjunction with local institutions, especially if they are located in smaller centres. The most important thing is alignment around a constructive agenda.

"In Alberta, the emphasis in most manufacturing sectors should be specialized factor-creation."

Industry Leadership

Networking is not a template business fad or government program. Each network takes shape and evolves in its own way. In fact, how a network evolves will not be predictable even to the people in the network itself. Networks are flexible; their direction arises from the sharing of information and perspectives that take place amongst their members. Governments are well-advised to move away from their fragmented, program-driven approach to services, and instead begin stimulating constructive dialogue within industry groups so that services can be tailored to the needs of specific industries (more on this further on). In the process, their spending will have far greater impact on the competitive development of the economy.

With respect to production networks along the Danish model, government and industry promoters should reflect on the differences between their local economy and the conditions underlying successful efforts in Europe. In Alberta, the emphasis in most manufacturing sectors should be specialized factor-creation as described in this paper, not joint production and marketing. Brokering cooperation between smaller groups of firms clustered either by community or industry segment, similar to the Danish model, is a good idea. However, the direction of this cooperation should be focused relatively more toward factor-creation than was the experience in Denmark. As we have seen, American network promoters have begun to see the need for this emphasis in their efforts.

"Most crises approach gradually...it is essential for brokers and promoters to stress early on the building of a common information base."

Casual observers sometimes forget the spontaneous origins of joint production and marketing work in Italy — the area that still has the most "dynamic" and robust form of cooperation. Dynamic production networks arose organically as Italian firms in factor-creating associations learned how to work together, faced common market pressures, and responded in ways that utilized their skills. The lesson is that industries will be more ripe for efforts to stimulate joint production and increased niche specialization once they have established effective factor-creating institutions.

Common Information, Common Crisis

In economies with strong traditions of business cooperation, the appearance of a business opportunity may itself be enough to engender network activity. In North

America, something more is usually required — a shared perception of competitive crisis. Most American networks were spawned in industries that were losing market share to foreign competition, where the superiority of the competition's quality was obvious and seemed to be growing.

As we have seen, most crises approach gradually, with few companies noticing until their "pot is boiling." Even with a true crisis emerging, people will perceive the relative impact of developing trends in different ways. If perceptions about the relative impact of the problems vary widely among members of the group, there may be too much suspicion about motives to sustain cooperative efforts. That is why it is essential for brokers and promoters to stress early on the building of a common information base — one that includes global industry trends, international competitor analyses, performance benchmarks, and evaluations of competitive gaps in local industry (quality, productivity, process technology, product innovation, etc.).

People seriously interested in promoting inter-firm cooperation should give special emphasis to creating constant exposure to this kind of information. It helps build a common understanding of local industry's position. With respect to government information, some surveys in other developed economies showed that international market intelligence services earned one of the lowest satisfaction ratings of any service. Respondents felt that it was too aggregated and out-of-date to be of use. (Nothdurft, 1992, p.41) Economic development agencies and trade associations will leverage their scarce resources well if they invest in strengthening their information infrastructure.

Early Payback

Most firms need to perceive an obvious and immediate common benefit if they are to become interested in networking. According to the experienced brokers at the Aspen roundtable, "attitude is less often the enemy of inter-firm cooperation in this case than is time. Owner/managers simply are unlikely to invest the time in exploring inter-firm cooperation without the clear potential for some fairly quick pay-off" (Bosworth & Rosenfeld, 1992, p.32).

Of course, not all the benefits (nor the most important ones) are short-term, but short-term gains are needed to generate momentum and interest. Common infrastructure issues are good places to start: front office systems support, worker training, market research, and qualifying and hiring consultants.

Personal Contact (Geographic Concentration)

Trust and communication are essential to the development of networks, especially those planning joint production or marketing. Network members must develop a common understanding of their industry situation, its threats and opportunities. They must negotiate agreements that everyone can live with, agreements that draw the line between cooperation and competition. They must resolve differences and difficult inter-personal issues. All these things entail direct negotiation. A base of personal trust must take the place of formal and legalisitically-regulated interactions.

Communication and trust only develop through personal relationships. People trust who they know and share experiences with. Face-to-face contact, as frequently as possible, is essential to making this happen. Even once networks are underway, rapid and constant communication is integral to the way that learning,

innovation and flexible response to the marketplace occur. Creative ideas and new methods travel quickly when the firms' owner-managers and workers enjoy frequent face-to-face situations. Informal social communication is just as important in making this happen as are formal meetings.

The importance of communication and trust-building has a number of implications for networking efforts. Firstly, geographic proxemity is an important ingredient in making production networks gel. A rule of thumb developed through the Danish experience is that production network participants should be located no more than an hour away from every other participant. This rule makes sense. Network brokers can act as a go-between for many routine transactions. In some cases, networks have used advanced telecommunications and information-processing technology to increase information flow. But these links can only enhance, not replace, direct communication.

"Production network participants should be located no more than an hour away from every other participant."

The geographic dispersion of many of Alberta's industries may act as a major constraint to the intensive development of production networks here. At the very least, there is a need to analyze the geographic and industrial clustering of Alberta's small manufacturing firms, something that has not been done to date.

Possibly a more important implication is the need to pursue networks in successive stages so that trust can build over time. Sponsoring social communication through guest speaker events, management workshops and so forth is an important precursor to in-depth cooperation. Trying to promote production network "marriages" (even with money) where people do not yet know or trust each other will probably fail.

Clear Goals and Agreements

"Each partner's knowledge of the other partners' expectations is a key to success."

Production networks in particular are prone to mutual distrust, bickering, or attempts by individual partners to dominate direction, unless clear goals and communication are present. Decisions must be made about which products and markets to pursue, short and long-term goals, and division of the spoils.

Production networks then can only work on the basis of trust, consistent strategic goals, and clear, simple agreements. Each partner's knowledge of the other partners' expectations is a key to success (Ramanujam & Rahn, 1993). So are clear agreements about what each partner will bring into the arrangement and what each will earn. Over time, success will breed trust and more spontaneous, flexible cooperation.

Brokers have a strong role to play in smoothing this process.

The Right Broker(s)

"Government network-promotion programs that put the wrong person in broker roles build potential failure into their efforts right from the beginning."

Brokers are people who sell the idea of cooperation, build trust between companies, and provide strategic leadership for networks. To accomplish these imposing tasks, they must command the respect and trust of network participants. In production networks, brokering might require more than one person, say a "market leader" and a trained, impartial facilitator if no-one is qualified to play both roles. A market leader would be someone with the following characteristics:

- He or she is intensely knowledgeable about the industry, and is known and respected in the industry. He might be a former (or retired) member of the industry or respected consultant. Often, a company from within the group commands enough respect and trust, and plays such a pivotal role

in the value chain (direct links with international customers, for instance) that it can play the lead role. The Italian impannatore are good examples.
- He has a marked and recognized expertise in an area important to the network — for instance, international markets/competitors, or technological trends.

The facilitator would have to be someone who:

- works in the occupation a significant portion of the time;
- has no conflicting interests; and
- has deep knowledge about how networks operate, the substantive and interpersonal barriers networks encounter, and how to overcome them (this knowledge may be gained or enhanced through participation in a broker training program).

Government network-promotion programs that put the wrong person in broker roles — for instance, a government representative with inadequate experience and another job — build potential failure into their efforts right from the beginning.

Section IV:

Defining a Networking Agenda for Alberta

Distilling the Lessons

In Alberta's manufacturing industries, there is no question that networks have an essential role to play in building strong SME competitors. The real questions are:

a) what forms of networking have special relevance here?
b) how should we be directing our efforts?

From our review of networking experiences in Europe and the U.S., a clear progression of priorities is implied for Alberta. Small manufacturers must first become convinced of the need to broaden their strategic horizons, focus more precisely, and aggressively pursue world-class competitiveness in their industries. This basic shift in orientation requires access to infomation and specialized support services. Only then can small firms begin seriously pursuing global niche strategies, either alone or in cooperation with other firms. Therefore, factor-creating networks should be the major priority in Alberta. Joint marketing and production has a place, but factor-creation is fundamental.

The experiences in Germany, Italy, Denmark and the United States each hold lessons for how Albertan networking efforts can be directed.

The German Example

"Small firms must have 'one window' into the services they need."

Germany's small and medium-sized manufacturers are among the world's masters of focus strategies. Formal production networks are not as much a part of the German landscape as in Italy and Denmark, but sophisticated factor-creating networks have played a leading role in the development of very strong mid-sized companies. The focus strategies of the mittelstand grow out of an environment in which active industry involvement ensures that the factors needed for competitiveness are tailored to industries' precise needs and made accessible to all firms, regardless of size. Public empowerment of private institutions is central to the process. Public services to German business are tailored in a number of ways:

1. They are targeted toward specific industry sectors and/or regions;
2. They are administered in many cases by chambers of commerce or trade associations; and
3. They are delivered by the private sector to the greatest degree possible.

As we saw above, chambers of commerce and trade associations run apprenticeship programs, actively shape the agendas of local educational and research institutions, and provide members with the market information they need. They broker cooperative efforts at many levels and encourage focus strategies.

The lessons for Alberta from this model include:

1. Collective private sector organizations must take a leading role in shaping the specialized infrastructure really needed by small firms.

The minimal services of trade associations and the atomized government program structure presently in place in Alberta are not effective in meeting the needs of small manufacturers. A small firm cannot liaise effectively with forty or more separately-administered public programs. Many firms quickly become frustrated and don't even try.

To the greatest degree possible, small firms must have "one window" into the services they need, and that window should to a large extent be private-sector

directed. To make this work, Alberta manufacturers must begin to gather in factor-creating networks (either industry-based, regionally-based or both) that make the most sense to their strategic needs, and begin to adopt a competitiveness agenda in the ways we have described above. This might mean working to influence and support existing associations, or organizing new ones.

Alberta's New Pressure Vessel and Value-Added Wood Manufacturer Associations

Two recent examples of promising newer institutions, both supported by the Canadian Manufacturers' Association (CMA), are the Alberta Pressure Vessels Manufacturers' Association (APVMA), and a new association presently being established — the Wood Manufacturing Council of Alberta (WMCA).

The APVMA is a professional association (established in 1987) to represent a competitive Alberta industry currently clustered around Edmonton and Calgary. With close to 20 members, the association represents about 70% of industry capacity in the province. The industry is technologically competitive, with many members using computer-aided design and drafting (CADD), well-trained engineers and skilled labour trained in local apprenticeship programs. Eighty percent of the members export, with markets ranging from the U.S. to the Pacific Rim, and Russia. Members are governed by the Boiler Branch — legislation enforced under the Department of Labour that ensures high quality through design reviews and inspection.

So far, cooperative activity has been limited in comparison to many of the European examples covered in this paper. Some members act as suppliers to others. Within the group, a member might have three or four direct competitors. There has been no joint production work. There are no common facilities.

Much of their effort has been directed toward lobbying. APVMA successfully lobbied to stop anti-dumping duties proposed by eastern Canadian steel companies against foreign suppliers to the industry. Current efforts are being directed at changing aspects of the Boiler Branch inspection system. Beyond this, cooperative activities have been limited to sponsoring technical upgrading through expert seminars, joint representation at trade shows, working with customers on specifications and commercial terms, and producing a video aimed at getting youth interested in the industry and its apprenticeship programs.

The Wood Manufacturing Council of Alberta (WCMA) is just now being established with the hope of representing the many small manufacturers that use wood beyond the commodity lumber stage. The range of members will include manufacturers of trusses, windows, prefabricated housing, office furniture systems, other furniture and kitchen cabinets. Many prospective members are already represented in national or regional associations specific to their trade, but the new organization would be better designed to deal with pressing local issues.

Albertan competitiveness in secondary wood manufacturing is constrained by two very important factors — lack of local sources of high-grade cuts of wood, and skilled labour shortages. Organizers are hoping that the new association will be able to help both situations through collective action.

Alberta's wood has the potential to be a very high quality input, but presently mills in Alberta are oriented toward commodity-grade lumber and do not have the equipment and processes in place to cut wood to the specifications needed for secondary wood manufacturing industries. This lumber is being sourced from out of the province. A strong association could work to convince local mills to invest in the processes required to serve their industry, an outcome that would result in higher value-added (and revenues) for the mills as well as cheaper materials for the user industry.

Secondary wood manufacturing requires complementary skills in modern production processes and a feel for the properties of wood. Alberta's technical colleges offer well-regarded apprenticeship programs in cabinet-making and separate programs for running computer-driven equipment. The result is a big shortage in labour skilled in both areas. Companies in Alberta wanting to utilize leading edge wood-manufacturing processes must invest large amounts in in-house training — a considerable constraint to the modernization of small firms. The new association hopes to make concerted efforts to fill this vital need.

The public sector should encourage and nurture this process in any way possible and it should help steer these bodies toward factor-creation and a competitiveness agenda. The community and industry-driven model of development envisioned in the *Toward 2000 Together* recommendations cannot work without properly-focused private sector groups driving the process.

Petro-Trade

An excellent example of the public sector seeding an innovative private sector networking initiative is the recent formation of PETRO-TRADE (Petroleum Services Trading Association of Alberta). PETRO-TRADE's mandate is to act as a coordinated international marketer for its member firms — to date, 52 Albertan oil and gas service and supply companies. Members include a complete range of oilfield service firms (geophysical testing, all aspects of production, transport, training and consulting and information management) together with manufacturers of pipe, equipment, pressure vessels, and others.

PETRO-TRADE is affiliated with a number of "support associations", such as the Petroleum Services Association of Alberta (PSAC) and the Canadian Gas Processors Suppliers and Geophysical Contractors associations, from whom it draws many of its members. Most member firms have already done some international work, but PETRO-TRADE is designed to enhance their efforts by offering international buyers "one-window" into Alberta's expertise.

By promoting coordination between members and selling Alberta's expertise as a whole, PETRO-TRADE intends to get Alberta firms involved in international partnerships and turnkey projects that individual companies could not otherwise handle alone. The approach will be to work with foreign oilfield leaders to pinpoint their exact needs and match them with groups of Canadian suppliers, in a long-term part-

nership approach to selling. PETRO-TRADE currently is working to generate large-scale projects in Kazakhstan (in the former USSR) and Latin America. It also brokers smaller-scale cooperation among members with complementary expertise, where one member has penetrated a market through channels upon which other members could "piggy-back".

Public partnership has been essential to getting this effort off the ground. Support funding for the establishment of PETRO-TRADE is being provided by the Western Economic Diversification (WED) branch of the federal government. This funding is due to be phased out over three years, at which time PETRO-TRADE will become self-sustaining through membership dues and other revenue-generating activities. Interestingly, this support is an innovative way for WED funds to benefit an entire industry. Using public money to support collective private sector efforts into international markets complements WED funding currently available to single company projects that do not adversely affect local competitors. The new approach offers the potential to greatly enhance the impact of WED money on the Western Canadian economy.

"Setting up mechanisms for gathering and widely publicizing information is an absolute priority for insuring that networking efforts take the right direction."

2. Within industry groups, build consensus around a competitiveness agenda.

German companies operate in an environment that focuses them on innovation, high quality and global market niches. They can focus in this way because their associations make available the kind of specific information they require at very little cost and inconvenience to small firms. In other ways we have discussed, the German environment pressures them to pursue high value-added policies. Because of this perspective, they "have their eye on the ball" in the sense that they work concertedly toward setting or meeting world standards of competitiveness. They participate actively in factor-creation because the challenges they face require access to sophisticated skills, technology and information.

Building this kind of consensus requires information — up-to-date, industry-specific, global information on customers, competitors, performance benchmarks and market and technological trends. Setting up mechanisms for gathering and widely publicizing this information is an absolute priority for insuring that networking efforts take the right direction. Confidential assessments of individual firms' manufacturing competitiveness are also extremely important. They can help managers realize they have deficiencies (Rosenfeld etal, 1992) and stimulate them to undertake well-focused improvement efforts.

"In the absence of a strong competitiveness consensus, our business culture will likely steer collective efforts toward static cost-based views of competition, and regulation-fighting."

In the absence of a strong competitiveness consensus, our business culture will likely steer collective efforts toward static cost-based views of competition, and regulation-fighting (witness the frustrations of the American network promoters described previously).

Inspiration from Italy

Emilia-Romagna's small manufacturers were the first to demonstrate the dynamism of production networks, and offer perhaps the most exciting model of how small manufacturers can be globally competitive. Networking is part of

Emilia-Romagna's business culture, so much so that new networks form almost as soon as new market opportunities arise. While Italian business owners are some of the most independent, individualistic people anywhere, they are opportunists as well. They seem to have mastered the art of balancing cooperation with competition, of dynamic networking.

Dynamic production networking, however, arose spontaneously from a very fertile environment. Environmental supports offer the most valuable lesson from Italy. Italians show the "service centre" concept in its most refined form. Industry and local government leaders in Emilia-Romagna have been able to translate the needs of swarms of small companies into a series of well-situated, carefully-tailored service centres that act as a catalyst for small company modernization, outward focus, cooperation and entrepreneurship. The tight geographic concentration of Italian industries around particular cities or towns allowed most centres to be designed to serve single industries, but other service centres offer functional expertise to several industries. Industry and regional targeting of services have both been used where appropriate.

The best lessons to draw from Italy include:

1. Industry groups and government should work together toward the establishment of service hubs for small manufacturers, in a process that emphasizes constant feedback and tailoring to local needs.

"Small companies need to minimize the confusion, lost time and headaches that accompany trying to access fragmented services."

Small companies need to work in long-term relationships with service providers that are intimately aware of local conditions and their particular needs. They need to minimize the confusion, lost time and headaches that accompany trying to access fragmented services often located far away. It also helps to have local institutions that "grease the wheels" of inter-firm communication by providing a physical setting that facilitates both formal and informal face-to-face communication.

In Alberta, a new effort, called the Alberta Manufacturing Network, has been undertaken to bring coordinated services to small manufacturers in their locales.

The Alberta Manufacturing Network

The Alberta Manufacturing Network (AMNet) was formed in 1992. The Alberta Research Council's Manufacturing Technologies Department will operate the network until it is ready to be managed by an industry-led group. Its principal purpose is to coordinate the services of existing support organizations to small manufacturers on a regional basis, as well as provide new services where gaps exist. The network considers its stakeholders to include not only small manufacturers, but also public and private service providers and academia. The thrust is to "widen and strengthen technology supply and distribution lines" by bringing an element of coordination and strategic thinking to existing processes.

One of AMNet's major avenues will be to push for the establishment of regional one-window innovation centres at various locations around the province such as community colleges.

An element that makes this initiative extremely promising is its focus on the provision of strategic information — something that could act to stimulate greater demand for modernization services on the part of ➡

small manufacturers. Through extensive surveying of manufacturers and discussions with stakeholders, AMNet has identified five priority services, inadequately covered by existing services, that it hopes to provide:

1. Assessment and benchmarking of manufacturing capabilities, so that firms are aware of their deficiencies and motivated to make improvements: AMNet will provide confidential assessments of individual company operations as well as comparisons against "best-of-class" competitors in important functions.
2. Awareness, education and training with respect to new manufacturing technologies, products, quality and operational improvements: AMNet plans to offer seminars and workshops, work with educational institutions to improve manufacturing education, and provide regional technology demonstrations at centres or on mobile units.
3. Access to strategic information: AMNet will work toward the establishment of widely accessible databases providing rosters of expertise, training, and technology suppliers, magazine and technical articles, and custom searches with respect to market research, competitive intelligence, patents and consulting.
4. Increased access to R&D assistance and funding: AMNet hopes to open new non-governmental funding sources and market these services more effectively to small companies.
5. Strategic alliances and partnerships: As described previously, AMNet will work with existing organizations toward the establishment of "one-window" assistance and regional nodes. It will also be involved in the establishment of a new service providing product innovations to machinery manufacturers in the resource sectors (in partnership with the Saskatchewan Research Council and the Prairie Implement Manufacturers' Association (PIMA).

AMNet is an exciting development in Alberta's current search for a demand-driven approach to economic development. Its success will depend on coordinating the services of other agencies that have different perspectives and agendas, and in building strong regional hubs that become the focus for services. Most importantly though, success will depend upon strong participation from SMEs.

2. Production networks are not a new organizational form so much as a new way of thinking. Dynamic networking becomes possible when small firms' sights are squarely set on global standards and opportunities, and when the practice of strategic cooperation becomes an entrenched way of looking at business opportunities.

The distinction between static and dynamic networks is important. Production networks at their best promote flexible specialization — coordinated action by highly specialized, innovative firms grouped in arrangements appropriate to market demands. In rapidly-changing markets, dynamic networks that can change their patterns very quickly are the best competitors.

In looking at production networks, too many people view them as new static organizational forms. They focus on "rationalizing" industries, eliminating "wasteful" local competition, creating economies of scale and stable internal structures. The recent popularity of the Danish model has probably resulted in misun-

derstandings about the ultimate goals of networking. In Denmark, the networking campaign was aimed at transforming the business culture so that Danish firms would incorporate Italian-style cooperation into their business mentality. Much effort was expended on nurturing cooperative habits between firms, and stable internal structures were necessary in this process. But to see the goal as stable new organizations is to mistake the means for the ends. Italian networks remind us that hyperflexible dynamic networking is the goal.

Alberta and the Danish Model

The Danish example of networking is capturing the excitement of policy-makers all around the world. The enthusiasm is spreading to Canada, where the Canadian Manufacturers' Association (CMA) has taken the initiative in trying to promote the networking concept to industry and the provinces through a new organization — the Canadian Business Network Foundation, or Can-Net (see box below).

Canadian Missionaries: Can-Net and CIBN

The Canadian Business Network Foundation (Can-Net) is a new initiative of the Canadian Manufacturing Association (CMA). After holding two workshops in Ontario for small manufacturers interested in testing the Danish network concept, and training four businessmen in the Danish Broker Training Program, Can-Net is presently working with several new production networks in Ontario. Can-Net's business plan is to demonstrate the viability of Danish-style networking in Canada through the Ontario pilots, and then promote these examples throughout Canada.

Can-Net is taking the lead in promoting the idea of production networks to governments across Canada. This initiative is designed to establish government funding which can be directed towards challenge grants and broker training similar to Denmark's program.

As networks develop in Canada, Can-Net will act as a resource centre, providing broker training and certification, workshops, roundtables, newsletters, lobbying and more.

The Canadian Institute for Business Networking (CIBN) grew out of the experience of successfully managing business networks in the Ottawa-Carleton high-tech sector. In particular, the Manufacturing Managers' Network has taken a tiered approach to developing trust in an organic fashion. The "general level" network sponsors prominent speakers and other activities intended to promote education and social interaction among 100 managers from 27 different companies in the region. From these activities, "interest groups" form to study specific issues (worker empowerment, purchasing practices, etc.) and share information for mutual benefit. The interest groups are stimulated often by speakers' ideas. They form spontaneously and dissolve when they no longer add value. Benchmarking, both internally and against international best practices, is a common activity.

From the trust built through the first two levels of activity, "subnets" are encouraged to form that undertake more in-depth cooperation — that is, production networking.

Facilitators are used to support each types of group, and help remove roadblocks to trust and cooperation. CIBN believes their facilitation experience is particularly appropriate to the Canadian context. One hopes that the Canadian penchant for undervaluing home-grown innovations does not cause this experience to go under-utilized as governments develop their networking strategies.

Both organizations have much to offer Canadian manufacturers and promoters in developing a Albertan approach.

Denmark's effort is captivating to policy-makers because it was a dramatic government campaign that achieved extraordinary results in a very short period of time. In three short years, almost half of Denmark's small manufacturing firms were in formal networks and expanding their markets! Who wouldn't want to duplicate such a feat?

As we have seen however, Danish firms started from a much stronger base of technical training, workforce skills, technology transfer and export orientation than is true in Alberta's small manufacturing sector. This does not mean that the Danish model has no value in Alberta; in fact, it has tremendous value. It does mean however that we should be channeling our networking efforts in a slightly different direction. While there is a place for production networks in Alberta, the fundamental requirement is the strengthening or creation of factor-creating networks. The lessons follow:

1. The Danish mechanisms of challenge grants and broker/facilitators offer effective means for changing the behaviour of small firms, but Alberta should use them to promote both factor-creating and production networks (with the emphasis on factor-creating networks).

As we have seen in this paper, the factor-creating mechanisms available to small manufacturers in most Alberta industries are poor in comparison to those existing in Europe. Small manufacturers don't have realistic access to the information, skilled workers, technology or markets they need in order to compete. A big part of the problem is that there are few effective factor-creating networks — industry organizations oriented towards global standards of competitiveness and committed to bringing the smallest of members whatever they require in order to compete.

Though the production networks put together in Denmark and the factor-creating networks most needed in Alberta are in many ways different, there are some strong parallels. Both require that firms learn to work together in new ways. SMEs need to enter into a process that is unfamiliar to them.

The Danish mechanisms might be excellent devices for encouraging both forms of networking where appropriate. Trained facilitators (brokers) could serve an equally effective role in factor-creating networks as in Danish production networks by:

a) creating opportunities for firm owners and managers to interact socially and build trust (CIBN's experience is particularly instructive in this regard);

b) keeping firms focused on a competitiveness agenda;
c) gathering strategic information;
d) working with government and educational institutions to establish service centres, and most importantly;
e) coaching firms in effective cooperation.

The Danish mechanisms offer excellent ways to facilitate the re-orientation of private sector firms. However, the Danish model also poses a direct challenge to the public sector.

"Efforts to transform a business culture are not achieved by adding yet another government program to an already packed program portfolio."

2. Efforts to transform a business culture are not achieved by adding yet another government program to an already packed program portfolio. They require bold, focused efforts, operated with appropriate scale and concentration.

The Danish networking program replaced a number of other government assistance programs with one coherent campaign tailored to the realities of Denmark's existing SME sector. It involved extensive research on the needs and perceptions of Danish companies, intensive preparation on the legal and taxation sides, widespread publicity, and well thought-out funding mechanisms. It committed US$25 over three years, a large sum in a nation of 5 million people.

The lesson for Alberta's government then should be about the need for leadership and concentration in order to empower small manufacturers. Alberta's approach is fragmented and uncoordinated on both the supply (support services) and demand (SMEs) side. If we want to shift from a "supply-push" to a "demand-pull" approach to factor-creation, we must commit. The Alberta Manufacturing Network is an effort in the right direction, but transforming the way small businesses compete, and governments deliver services, in Alberta will require much more. In a time of fiscal constraints, "more" does not mean adding new spending so much as redirecting current development funds.

As many businesses are currently learning in their efforts to "re-engineer" fundamental work processes, trying to patch a couple of "coordinating mechanisms" on top of a structurally uncoordinated system doesn't work (Hammer, 1990). Simply redrawing lines on an organizational map doesn't either. Bold efforts to start from the customer's perspective and structure services accordingly require deep changes in the whole way the organization interacts with its customers and conducts daily work. European service centres offer one example of how this can be done.

"The challenge of the re-engineering concept to government services must be addressed."

In making good on the vision of *Toward 2000 Together,* the challenge of the re-engineering concept to government services must be addressed.

America's Experiments and Alberta

America's experience with networks is especially instructive to Alberta because the business culture closely parallels Alberta's. American networks and their government sponsors are struggling with the same issues that will confront Alberta as we begin seriously pursuing networks in our SME sectors.

The biggest lesson from the United States is:

Put networking in its proper context. The goal is small company competitiveness and modernization — small companies engaged in long-term upgrading and focused on international opportunities and competition.

Networking must be conducted in this context to be effective. On the private sector side, the development of strong factor-creating networks is crucial. On the public sector side, the promotion of Danish-style networks should be only one part of a demand-driven restructuring of services designed to help small companies compete. The American programs described above (Rosenfeld) offer excellent examples of how such services could be developed.

A Networking Agenda for Alberta

Networking efforts will evolve in Alberta organically as governments, industry leaders and small company owners come together to discuss how the idea applies to their industries. We hope the principles discussed in this paper can act as a guide to effective strategies.

While the shape of networking in Alberta cannot be predicted or prescribed in advance, there are some actions that interested network promoters can take immediately to lay the groundwork for subsequent efforts. In particular, more research is needed in the following areas:

1. The Alberta economy must be more precisely "mapped" in terms of SMEs in high value-added manufacturing, specifically focused on clarifying linkages and local clusters.

While industry-specific manufacturers' indexes have been constructed, no efforts that we know of have yet been made to identify geographic concentrations and the linkages between firms. As well, Michael Porter's competitive diamond model is being used by the Economic Development and Tourism Department to identify Alberta's general industry clusters. But in the study completed so far (on the wood products cluster), small high value-added manufacturers received only general mention. A more thorough mapping would include continued economic analysis along these lines, but would be accompanied by extensive surveying of SMEs designed to discover:

"Mapping would include economic analysis accompanied by extensive surveying of SMEs."

- where they are located;
- who their major customers, suppliers and competitors are;
- what local public or private service providers they utilize;
- their current views on technological and market trends in their industry, their own relative competitiveness, and their future needs;
- what trade associations or other industry groups they belong to;
- the degree to which they cooperate with other firms.

2. Related studies should be undertaken to understand the current membership boundaries, strength and attitudes of industry associations and chambers of commerce serving Albertan small manufacturers.

To create the kind of factor-creating mechanisms seen in the most competitive SME sectors, firms must work through collective organizations (networks) that represent their long-term interests. Orientation and attitude are extremely important. One possible avenue to strong factor creating networks in Alberta is through reorienting current industry groups. Alternatively, the establishment of new organizations (like the APVMA and WMCA described above) will be required.

Whatever the case, an inventory of current industry representation will help target future efforts.

3. Continue current efforts to coordinate government services to SMEs, and use the principles described in this paper to elicit greater participation by SMEs in creating a demand-driven approach to business support services.

The Alberta Manufacturing Network (AMNet) is a promising move in the right direction in terms of how the public sector assists small manufacturers. Efforts along these lines should be empowered with full funding and support. However, the shift to demand-driven support will only reach its potential if SMEs participate fully through factor-creation networks.

4. Study both CIBN's networking experiences and Can-Net's pilot production networks in Ontario closely, and consider promoting production networks in appropriate sectors of Alberta's economy.

Production networks have a role to play in the development of Alberta's manufacturing sector, and as our industries develop, the role should grow stronger. The enthusiasm behind this recommendation is muted only in the sense that factor-creation is a priority and should be the primary focus of networking efforts in Alberta's value-added sectors. We also believe that CIBN's networking model, derived from experiences in a Canadian context, offers many lessons for Albertan efforts.

Conclusion – Networking: A Process, Not a Program

"One possible avenue to strong factor-creating networks in Alberta is through reorienting current industry groups."

In Alberta's current quest for economic development, networking will be essential to building on our strengths and raising the competitiveness of Alberta's small manufacturers. Because of the nature of Alberta's manufacturing sector, we feel that infrastructure-building cooperation is the greatest priority here. Variants of the Danish model also have a role to play, though a secondary one.

The point to remember is that the most dynamic examples of production networking do not happen in a vacuum; they grow out of a strong base of technical competence and infrastructure that is continuously being upgraded. A significant part of this infrastructure is information — relevant information on international markets, competitors, performance benchmarks, and technology that motivates firms to upgrade and compete from a global perspective. Production networks also grow out of a social climate that promotes face-to-face contact and trust building.

With infrastructure in place, SMEs can be globally competitive, either growing into medium-sized companies that pursue markets independently (like Germany's mittelstand) or working in production networks. But in the absence of competitive infrastructure, production networks will not be significantly more competitive than individual firms. For this reason, factor creation is by far the most fundamental and important focus for cooperative effort.

This general warning is needed not only because of the confusion that often surrounds the word network, but also because of the potential temptation that comes from trying to copy ideas that have worked in other parts of the world without fully understanding them. Production networking programs such as the presently popular Danish model may even be dangerous to try to imitate if they are poorly understood. Many people will see the model as a way to rationalize indus-

tries, eliminate "wasteful" competition and achieve economies of scale. But as we have seen, firms do not become more competitive simply by becoming parts of bigger units; innovation is what drives competitiveness.

Maintaining a competitive dynamic within networks is extremely important for driving innovation, and this fact should not be overlooked in efforts to build production networks. Networking is not about eliminating local competition. It is about raising the plane of local competition (in terms of world competitiveness and innovation), lowering its risks and increasing its rewards for small manufacturers. It requires that small firms learn how to balance competition and cooperation. This means distinguishing when it is better to share information, work together, build resources and pursue markets collectively; and when it is time to compete to secure the best opportunities within a new competitive arena. The nature of local competition then is no longer a narrow, localized ethic ("I win, you lose"); it shifts to a global perspective which says in effect "Everybody wins, but some more than others."

Possibly the best way to think about networks is as an activity or process, rather than a static noun — networking rather than a *network*. In this thinking, networking is fundamentally a mindset, a strategic way for small firms to shape their environment to build long-term advantage. It offers access to specialized resources in the local industry and institutional infrastructure, and creates an environment that makes intensive learning, innovativeness, and world-class competitiveness possible.

Networking works for individual small manufacturers because survival and success requires that they focus their efforts, build specialized skills and master the art of marketing high value niche products. To make these strategies work, firms must have local institutional support and access to accurate, up-to-date, and industry-specific information. They must have lean, productive and technologically-competitive operations, and systems in place that motivate and nurture constant improvement and learning. And they must leverage their advantages to the maximum extent possible in terms of reaching lucrative markets. Networking can help small companies along all these fronts.

Finally, competitive networking requires a new approach to the interaction between the public and private sector. Perspectives and attitudes must change if governments and small manufacturing companies are to work together effectively. This paper has tried to outline the principles by which such a process can work.

"Firms do not become more competitive simply by becoming parts of bigger units; innovation is what drives competitiveness."

Appendix:
Networks in the United States

Network Initiatives in Traditional Manufacturing Industries

The Oregon Wood Products Network. This network evolved as a response to (1) the slowdown in new residential construction in the United States, and (2) new land use management regulations to protect the habitat of the spotted owl. Oregon legislation established a Wood Products Competitiveness Corporation with a board composed of seven people from the industry. Thus, the private sector directed the use of the funds and encouraged interfirm collaboation. Specifically, public funds were provided to the Corporation to allocate for training network brokers, providing challenge grants as incentives to form collaborative activities, giving service vouchers to firms for partial costs of services and with incentives for group services, and providing technical assistance through an industrial extension service. The State has adopted benchmarks to measure the program's performance that will be used to assess the pay-off from the experiment (Rosenfield et al, 1992).

Note: The rest of the examples under this section come directly from Kirchner, 1991).

The Targeted Development Project of the Jane Addams Resource Corporation (JARC) founded and coordinates a consortium of metalworking firms in two Chicago neighborhoods. Project staff conduct in-depth research, provide information and offer training and sales activities for the member metalworking firms in order to preserve and expand employment opportunities for economically disadvantaged recipients in the areas served. Thirty-seven firms have committed to exchange business and ideas, to collectively pursue larger, multiple production contracts and to assist each other with shared equipment and resources. Last year, JARC services staff, acting as network "manager," landed $275,000 in contracts for members, helped produce a joint catalog and supplied job training for 60 vacancies. Additionally two new products were jointly developed in the lasta two years.

JARC emphasizes the modernization of equipment as one important strategy for increasing the business done by consortium firms. To encourage modernization, the project sponsored an eight-week quality control training service, which helped document the places in the metalworking production process that were problematic and, therefore, needed to be upgraded. An Illinois state training agency has since agreed to provide scholarships covering 50 percent of enrollment fees for similar sessions in the future.

The Heat Treaters Network, Inc. was established in August 1990 on behalf of 98 steel processing firms who are dedicated to solving industry-wide technical problems so that each firm can independently regain its competitive edge in the international marketplace. Currently 15 small firms are actively participating in the Ohio-based network which has forged a research alliance with that state's Edison Materials Center. Now that 15 small business owners have been involved in the program, efforts will be directed to reach larger sized firms.

The network has a formal organization in place and has begun to decide where funds are going to be committed with respect to problem solving efforts. Areas being considered include: parts distortion, evaluation of standards relating to the cooling of parts, quality control, and productive models. Funding in the amount of $286,000 was provided by the State of Ohio from its Steel Futures and

Networking Funds. The Heat Treaters Network is the first flexible manufacturing network in Ohio and is being used as a model for five other start-up groups.

The Michigan Magnetic Manufacturers Joint Purchasing Co-op in Howell, Michigan was established as the result of a state Modernization Service Grant. Through the co-op, four to five firms that produce transformers and coils have banded together to purchase basic commodities such as copper magnet wire at a discount, resulting in a 20-25 percent savings. In establishing the purchasing network, it was determined that (a) no monetary data would be shared, and (b) no state firm that wished to be considered as a supplier could be excluded from bidding. A law firm was retained to handle the solicitations and four vendors were selected to provide the products needed by the firms involved in the network. The Michigan Department of Commerce said that the purchasing co-op had been the most successful of any of the 15 business modernization grantees.

The National Institute of Flexible Manufacturing established a shared manufacturing facility in Meadville, Pennsylvania in a converted racquetball court. The facility contains some of the world's most sophisticated computer-run technologies for precision metal cutting. By renting time in the common facility, independent tool and die shops in the region are not only learning how to use these technologies but are also turning out better products for their customers, and they are doing it in less time and at less cost on equipment that they would not otherwise have been able to afford.

Eight firms in the area have joined the network which was started with the help of $441,000 in state and federal grants. It was expected that half of the institute's 1990 budget of $750,000 would come from user fees for rented machine time and worker and management training. The manufacturers use the facility on a job basis. They are taught programming and new techniques for running the equipment on an unattended basis. Getting the individualistic firms in the area to use the institute has been a problem, but necessity has driven some companies to the institute's doorstep.

The Columbus Enterprise Development Corporation (CEDC), with the support of the Indiana Business Modernization and Technology Corporation, is working closely with three industrial networks in its service area. The FlexCell Group, an unincorporated vertically integrated network composed of a design firm, a marketing company, an engineering firm, and a plastics and a metals company, is attempting to jointly develop new products. To date, FlexCell has responded to the rapid prototyping demands of a major automotive OEM, generating a part for a contract opportunity. Another network in the area has initiated a joint quality improvement program, contracting with a consultant to develop Total Quality Management Programs for member companies. Each of the six member firms contributed a total of $40.000 to hire the consultant, which was matched by state cash contributions and in-kind contributions from the consultant.

The Arkansas Science & Technology Authority (ASTA) has awarded five network Challenge Grants to expand the scope of existing consortia, and institutionalize—through the creation of hubs—network activities in the state. Eight to ten grants are expected to be awarded, which require a 50 percent match from the grantee. The funded projects span the state from the Delta region to the Oklahoma border, and involve small and medium-sized businesses in the wood products, metals, and chemicals industries. The funded network brokers are predominantly

public and non-profit organizations and include Community Colleges, a University, and an existing network.

The Arkansas Metalworking Connection, Magnolia, Arkansas, was established as a joint venture by Southern Arkansas University, University of Arkansas, and Henderson State University to provide services to metalworking firms in the state. There are currently 52 members who pay nominal dues ($15 per member) that are used to cover the cost of a newsletter, postage, etc. Other costs are covered by the participating universities.

One of the Connection's first projects was to produce an invoice capability book in which an inventory is provided of the capabilities of member firms and any special equipment they may have. Through this resource members are able to contact and work with each other on particular projects. This often results in saving in transportation and other costs. Also being planned is an apprentice program that will be operated by Henderson State that will supplement classroom training with hands-on experience in member firms. In addition to these types of services, the organization sponsors a group insurance program which has resulted in considerable saving to member firms due to the group rates offered.

The Maine Research and Productivity Center, at the University of Maine, Presque Isle, Maine, has established a centrally located computer aided design/computer aided manufacturing (CAD/CAM) facility which 10 firms are currently using to greatly enhance their production methods. The project was funded with a $60,000 grant from the state and each of the 10 participating firms contributed $1,000 each. Companies such as IBM and Hewlett Packard practically gave the project computer equipment and programs to help get it started. Participating firms are allowed six months of unlimited access to the CAD/CAM systems and are eventually brought to the point where they obtain their own systems. Hewlett Packard has profited from its initial contribution through the sale of six systems at full retail prices. The results have been spectacular according to the center director, Bill Forbes, and one company has been even able to generate overseas contracts because of its new sophistication and ability to bid against large companies. Also, other manufacturing groups in the state want to duplicate the project at Presque Isle.

Renewal in Silicon Valley

The United States contains a unique brand of network in some of its high-tech industries — one that is neither a republic of small companies or nor kingdom dominated by a large company. This hybrid form is flourishing in Silicon Valley, and it demonstrates how highly technologically innovative small companies can establish strategic partnerships with other companies of all sizes and extend its strategic reach without being dominated by its sometimes larger (in some cases huge) partners.

Silicon Valley has seen a recent resurgence in its semiconductor industry lead by a whole new generation of companies. Companies like Cypress Semiconductor, Altera and Weitek are smaller specialty chip designers and manufacturers. By focusing on short runs of high-performance components and custom products targeted at niche markets, these companies are consistently able to stay at the forefront of the innovation process and introduce new products much faster

than traditional semiconductor companies. They do this by establishing strong horizontal ties with each other and sometimes with bigger companies.

Most of these strategic alliances involve technology sharing, subcontracting of chip fabrication or joint product development. For example, Altera is a company with 300 employees and $60 million in sales (1990 figures) that makes programmable logic devices. Altera has no chip-production facilities. Instead, it has formed strong alliances with a variety of small and large chip and computer systems manufacturers. Altera has a several million dollar equity stake in Cypress Semiconductor: Altera gets a guaranteed fraction of Cypress's output at cost-plus and early access to the company's next-generation manufacturing technology; Cypress gets a cash infusion, the opportunity to produce at capacity, and a right to Altera's state-of-the-art products. Altera also has an agreement with the much-larger Texas Instruments: TI receives licenses on Altera's second generation products; Altera has the right to use some of TI's manufacturing processes at other semiconductor manufacturers. In no way does the relative size of the two companies reflect their relative bargaining power.

There are many other examples of small high-tech firms entering into these innovative types of partnerships. Between 1979 and 1990, new semiconductor start-ups in Silicon Valley forged 350 alliances with each other and with other companies of all sizes. Their success is based partly on the regional infrastructure — Stanford University, trade associations, local business organizations, and specialized consulting, market research and venture capital organizations. The emphasis on maintaining a dynamic balance between cooperation and competition is also important. For instance, both customers and suppliers make an explicit effort to avoid dependence on any one company and to preserve their own autonomy. Most Silicon Valley companies prefer to limit any single customer account to no more than 20% of their output. The overall result is a networking system in which companies share the risks and costs of innovation: they leverage their presence in the marketplace, lower their fixed costs, and get products to market faster. Product life cycles have shrunk from more than two years to an average of nine months (Howard, 1990, p.101-2).

This kind of networking in Silicon Valley represents an excellent model uniquely suited to dynamic small firms with high levels of technological expertise. At the same time though, some people feel that these firms will have to formalize their cooperative work to a greater extent through the development of service centres (for worker training, international market intelligence, cooperative marketing, etc.) if they are to remain competitive over time (Saxenian, 1990).

Other High Tech "Hot Spots"

Silicon Valley has in turn spawned other successful attempts to facilitate accelerated growth in high-technology industries. Of particular interest are a number of successful, relatively new high-technology "hotspots" situated at various locations around the U.S. They include concentrations of laser and opto-electronics firms in Tucson, Arizona (called "Optics Valley"); software firms in Orem, Utah ("Software Valley") and Champagne/Urbana, Michigan ("Silicon Prairie"); computer manufacturing and chip firms in Austin, Texas ("Silicon Hills"); medical products and biotech firms in Philadelphia ("Medical Mile"), Minneapolis/St. Paul ("Medical Alley") and Salt Lake City ("Biomed Mountains"); and the list goes on.

Fifteen of these new hotspots are presently supporting 600,000 high quality jobs and impressive growth in income and exports in spite of the recession. (BusinessWeek, 1992)

These areas tend to share a number of features:

- they offer a high quality of life, with cheap housing, little crime, and plenty of recreation close at hand, making them attractive places for highly-skilled people to live and work,
- at their heart is often a major research university that acts as a magnet for big companies and entrepreneurs. Big companies come to harvest ideas from researchers and start-up companies, effectively trying to be the first to market with new ideas,
- they offer easy access to venture capital, skilled workers and support services.

At the heart of these highly localized centres is an uncommon alliance of state and local governments, business and local universities. The lesson seems to be that:

> ... while different levels of government can build infrastructure, fund universities, and provide seed capital, the real key lies with local coalitions of business leaders and educators. The approach that works best is local and decentralized. (BusinessWeek, 1992, p.82)

Achieving a common understanding among an area's university, business and government leaders is seen to be the most difficult part of establishing a hotspot. Most of these areas have alliances or councils to bring people together and build trust. Once coordination is achieved, the coalition makes a detailed map of what industries it already has, along with its educational, financial, and support institutions, and then creates a strategy to fill in the gaps and nurture businesses that show promise.

A number of things follow. Hard work goes into developing a local skill-base that will attract companies. University research funding is targeted with commercial spin-offs in mind. The technology transfer process from the universities is paid a great deal of attention to. Active technology transfer departments bring together faculty, companies, local entrepreneurs and venture capitalists. Some universities are allow professors to collect the largest portion of commercial royalties on their developments. Special efforts are made to tap and coordinate local sources of venture capital (ongoing lists of interested investors are regularly contacted, databases are set up, etc.). In short then, it seems many elements have to coalesce in a special chemistry of cooperation and good ideas in order for the hotspot phenomenon to emerge.

The hotspot model gives us a good sense of the kind of public-private networking strategies required to support high-tech industries that place a premium on new product technology.

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