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**Flexible Manufacturing Networks and the
Washington Wood Products Industry**

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FLEXIBLE MANUFACTURING NETWORKS AND THE WASHINGTON WOOD PRODUCTS INDUSTRY

*Report for Center for International Trade in Forest Products
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EXECUTIVE SUMMARY

The wood products industry in Washington has exhibited little growth in real value of output in the last decade, and increases in employment are small as new technologies boost worker productivity. Meanwhile, firms face competitive challenges from foreign producers as well as competitors in other regions of the United States. Wood supplies are not assured either. The U.S. Forest Service is implementing new land management policies and responding to environmental concerns such as providing habitat for the spotted owl. Private land management is also an issue, since some private land owners may not be interested in managing lands to produce a stable, long-term timber supply.

To remain healthy in the long run, these firms need new markets and improved technologies, a capable labor force, reliable wood supplies, and an adequate supply of capital. None of these crucial factors is assured in our rapidly growing and swiftly changing economy.

A demonstrated, successful strategy for maintaining the vitality of small businesses is to link small firms together to accomplish commonly needed tasks such as marketing, research and development, employee training, or production of goods and services. This organization of firms is formed along sectoral linkages either horizontally (several firms producing similar products) or vertically (firms linked as a set of buyers and suppliers). This concept, known as Flexible Manufacturing Networks (FMNs), originally arose in Europe. Many countries now devote considerable resources to the promotion and servicing of FMNs through sector-specific institutes and programs, much of it privately financed by the firms receiving the services. Denmark and Italy have advanced industrial economies with a size distribution more heavily favoring small and mid-size firms than in the U.S. They provide useful models for examining the Washington wood products industry and determining strategies for strengthening the subsectors in the industry.

Primary and secondary research has been performed on the wood products industry in Washington to identify key issues and problems faced by the small and mid-size firms and to assess the feasibility of implementing FMNs and other similar strategies. The manufacturing sectors (SIC 24 and 25) of the industry exhibit strikingly similar characteristics to that of many of the manufacturing sectors in Europe in which FMNs have been successfully implemented. Wood products manufacturing is more heavily dominated by smaller firms that show subsectoral concentrations in many of the state's rural counties, use labor-intensive processes, and produce goods that have great potential as specialized and high quality products and niche market penetration in the international economy.

A randomly selected sample of firms in Grays Harbor, Lewis, and Spokane counties was surveyed to gain a deeper understanding of their attitudes, operations, and needs. This helped to assess the industry potential for network development. Among the aspects examined were the size and distribution of firms, growth trends, the state of technology, the quality and availability of the labor force, major markets and products, significant competitive challenges, and evidence of prior collaborative behavior among firms in the industry.

For analytical clarity, the industry is bifurcated into its primary and secondary processing sectors. The former is composed of firms performing milling of raw logs or manufacturing boards, panels and roofing products that are used as inputs in further processing or construction. Secondary processors are those creating finished products such as doors, windows, trusses, modular homes, and furniture from milled timber. Both groups exhibit concerns about many of the same issues, such as timber supply and government regulations and support, and are in need of unskilled, trainable labor. However, the extent and focus of their concerns, and individual firm characteristics, are distinctly different between the two groups.

Relative to secondary, primary processors tend to consist of larger firms with a more national and international market focus, are more dependent on local timber, exhibit greater rural concentration, and possess more diversity in their level of technological sophistication (running along subsectoral and firm size divisions). They are greatly concerned about access to timber supply, and generally displeased with the lack of federal effort to help U.S. firms compete against the Canadian and Asian wood processing industries. While secondary processors have been faring well in local and regional markets, only a select few subsectors within the secondary processing sector show a larger market focus. Often the small size and lack of marketing skills and capital of these firms are limiting factors in their ability to grow and expand. Forms of collaboration have remained rather informal in both sectors, with smaller firms exhibiting a greater tendency to work cooperatively. Yet, in general, firms tend to exhibit a fear of the risk that accompanies joint ventures. Finally, there is a definite wariness toward governmental (federal or state) assistance and intervention in the affairs of small business.

Washington has developed a solid foundation of public sector business assistance programs and service providers, upon which programs for Flexible Manufacturing Networks can be built. Out of a well-managed public effort stimulating private sector firms and associations to become involved, flexible network structures can be developed in the wood products industry. Obstacles to be overcome include firms' fiercely independent attitudes, concerns about collaboration, and their lack of time or money to put towards network development. In addition, a much better outreach effort must be made to smaller firms, for which networks are most suited. Many of these firms have either been unaware of or ignored by existing assistance operations.

The public service providers must also have a greater knowledge of the wood products industry, its technology and specific issues of its firms, and develop programs that require less perceived risk to the firms involved. By concentrating state assistance efforts and consolidating the retailing of assistance programs into a small number of knowledgeable providers working in the field, a public sector structure is created that will better work to involve firms into the economic development programs and can introduce network service and facilities centers into the private sector with greater ease than presently exists.

Each type of firm, primary and secondary, can benefit from forms of government assistance, but the programs must be tailored to each sector specifically. Initial strategies to assist firms may not involve formal network operations, but in time, and with increased public sector experience and private sector familiarity and acceptance, they can be developed into privately supported Flexible Manufacturing Networks. Specific programs which can be developed for secondary processors include marketing research designed to assist the smaller firms who possess little knowledge about potential markets for their products, and the development of programs to more fully promote and utilize Washington wood and wood products as specialty, high quality products. In addition, primary processing firms need assistance in obtaining the full extent of available technologies in the industry, which can help reduce reliance upon specific log species and sizes. By creating state economic development strategies which address specific issues in each sector and reach the firms in greatest need with sectorally-specific field agents and service centers, the state could create a foundation of public and private strategies that can encourage the process of Flexible Manufacturing Network building.

INTRODUCTION

The wood products industry has long provided a vital foundation for Washington's economy. It has been an important source of jobs and income in logging, milling, processing, and related finished products throughout our hundred year history. In many rural areas, this industry is responsible for virtually all manufacturing jobs, thereby providing the highest wage employment opportunities in these areas. Recently, internal pressures and international restructuring of the industry have reduced the competitiveness of the state's firms. Statewide environmental and recreational concerns have restricted the allowable cut. New technologies introduced in the past decade have increased efficiency, resulting in fewer jobs. Industry-wide global restructuring has created increased competition from national and international logging and processing firms. To maintain its strong position in the production of lumber and related wood products, Washington must find ways to revitalize its industry and preserve its jobs, revenue, and status as a leader in the wood products industry.

Wood Products in Washington

Wood products, which includes the U.S. Standard Industrial Classification (SIC) sectors of forestry, lumber and wood products, furniture and fixtures, and paper and allied products, represents the second largest industry (after aerospace) in Washington. In 1988, over 60,000 people were employed directly by the industry, which generated well over \$400 million in wages in the first quarter of 1988 alone. The industry directly and indirectly supports a substantial number of residents across the state. Not only are the industry's sectors closely linked to each other, but they have substantial economic ties to other sectors of the state economy. This is exhibited by the figures for direct impact of final demand for wood products, as derived from the Washington State Input-Output Study for 1982 (Bourque 1987).

Table 1 shows the impacts of the earnings and jobs multipliers for the wood products sectors of the state's economy. Column 1 indicates the total income earnings impact of every \$1 million final demand in each sector. Similarly, column 2 gives the net impact upon jobs in the economy. The averages calculated at the bottom indicate a higher than average impact upon earnings by final demand changes. Cost significant are the averages obtained by separating out the sectors representing only wood products manufacturing. The wood products manufacturing sectors, composed of SIC codes 24 and 25 (lumber and wood products, and furniture and fixtures, respectively) are the focus of this study. The multipliers for wood products manufacturing indicate that they produce more than \$140,000 greater earnings and over five more jobs, per \$1 million final demand, than the state average of all industries. These statistics show that, in addition to the relative importance of the industry as measured directly by jobs and income, the sectors also exhibit strong linkages to other sectors of the economy and above-average impact on the state's economy.

The Research Project

The Northwest Policy Center (NPC), through a grant from the University of Washington's Center for International Trade in Forest Products (CINTRAFOR), has studied the feasibility of implementing Flexible Manufacturing Networks (FMN) as part of an economic development strategy in the Washington wood products industry. FMNs have been successful in revitalizing lagging manufacturing industries and maintaining the competitiveness of small firms in parts of Europe and the United States. FMNs employ cooperative efforts between firms, within a competitive framework, for the production of value-added or specialized consumer durable and capital goods products.

This paper is the culmination of that research. It includes a review of the theory and concepts behind FMNs, an assessment of the needs, potential, and barriers to FMNs, and a set of policy recommendations to help develop network strategies in the Washington wood products industry. The components of the project are:

1. A review of the literature on Flexible Manufacturing Networks and an analysis of the industry sectors and regions where they have been implemented successfully. Emanating from this will be a set of industry characteristics conducive to the development of FMNs.
2. A description of the current structure and economic conditions in the Washington wood products industry. Those sectors with the greatest potential for FMNs will be identified.
3. The results of industry association and firm surveys are presented in an analysis of the issues and problems faced by the wood products industry.

4. **Analysis of policy alternatives and development strategies that fit within the framework of FMNs, including direct recommendations for and potential barriers to their creation.**

FLEXIBLE MANUFACTURING NETWORKS

The Economic Setting

There is a substantial literature about the recent spatial and structural transformations occurring in the global economy. Large, mass-production manufacturing firms that have long provided the economic foundation for Europe and North America have experienced, since the 1970s, increased competition from developing nations. Developing countries have a large pool of low-wage labor, lower taxes, and fewer work place and environmental regulations. These competitive advantages, in conjunction with the increasing technological capabilities that have produced lower skill requirements in the manufacture of formerly labor- and skill-intensive production processes, have attracted much of the industrial production formerly dominant in the industrialized regions of the Western developed nations (Friedman 1987; Hatch 1988a, 1988b; Piore and Sabel 1984a, 1984b, 1985; Powell 1987; Sabel 1982, 1987; Scott 1988; Valery 1987).

Over the last two decades, the industrial manufacturing economies in Europe and North America, built around "Fordist" assembly-line mass production techniques, have felt the reverberations of this change. Michael Piore and Charles Sabel cite many factors for this restructuring, which they call the "Second Industrial Divide" (the first was the Industrial Revolution). The root cause of this "divide" is technological change, which induces market changes. While new technological developments have caused the shocks in these formerly stable industrial economies, technology will also enable these economies to regain their competitive position in some manufacturing sectors.

The wood products industry is not immune to these powerful forces. Increasing costs and declining market shares and resource base are factors in Washington's loss of competitive position in the wood products industry. Only recently have foreign and domestic market sales equaled the peaks reached prior to the recession of the early 1980s. Yet, overcapacity remains a problem as available timber supply is not capable of meeting this demand. The problem is intensified by intense competition from Canadian and southeastern U.S. mills. New process technologies have kept labor demand relatively low while output has risen since the recession. Many mills remain dependent on an aging, dedicated capital stock, and are unable to process second-growth timber, which is replacing the depleted old growth supply. These issues of technological change and shifting supply characteristics are faced in the context of increasing national and global competition and economic change.

The Washington state wood products industry recently has experienced detrimental impacts from this globalization process, as indicated by Bagger and Waggener (1985) in their overview of the state's industry, and echoed by Anderson (1988:226):

The housing and interest-rate recession of the early 1980s taught the wood products industry a painful lesson: despite its exports, the industry had overrelied on domestic markets. All our traditional industries must come to recognize that increasingly we are living, working, and competing in a global economy. In the future the opportunity for this industry lies in broader international trade.

Washington is among the world's highest cost producers of lumber and wood products (Washington Department of Natural Resources 1986). To insure its future success, the industry must utilize the full capabilities of new technologies to develop new forms of production and organization (particularly those that promote greater value-added manufacturing), instead of merely attempting to overlay new techniques onto existing structures. The concept of Flexible Manufacturing Networks has proven useful as a strategy to reorganize industrial structures to effect revitalization in manufacturing industries elsewhere. It can do the same for Washington as it faces strong competition in international wood products markets.

An Era of Flexibility

In an era when the pace of technological change was relatively slow, when production processes were well understood and standardized, and when production runs turned out large numbers of similar products, vertical integration was a successful strategy. But the disadvantages of large-scale vertical integration can become acute when the pace of technological change quickens, product life cycles shorten, and markets become more specialized. Firms are responding to these new pressures in a variety of ways, either by explicitly limiting the size of work

units, or by contracting work out, or through more collaborative ventures with suppliers and distributors (Powell 1987:73-4).

The statement introduces some economic effects of technological change. It calls for a reorganization of production methods to meet the changing structure and competition in the world economy. Reorganization can be effected by the concept of flexible specialization, introduced by Piore and Sabel, which breaks the tradition of large, rigid, mass production manufacturing around which the world's industrial economies have been built (Piore and Sabel 1984a, 1984b; Sabel 1984, 1987).

Flexibility is defined as "the capacity continually to reshape the productive process through the rearrangement of its components" (Piore and Sabel 1984a:269). Specialization is a restrictive characteristic in which output possibilities are bound to a single product trajectory, limited by factor input redeployment potential. Within the framework of flexible specialization, competition and innovation drive the processes of technological change and economic growth that occur within the ever-changing, flexible firms. Through this dynamic process these firms are able to remain competitive. Flexible specialization techniques are presently being utilized by manufacturing industries in West Germany and Japan, as described in detail by Sabel (1984).

Some large West German firms that would otherwise be rigid, unchanging manufacturers use a technique that exploits automated, flexible manufacturing systems. Computer controls maximize the flexibility of the high technology, modifiable production equipment, factory units are decentralized, and worker skills are constantly upgraded to meet the demands of the new process technologies (Sabel 1984:349-50). This has proven successful in the German steel and metalworking industries. Many Japanese industries maintain large firms for final assembly and marketing operations, but farm out product inputs and innovation to numerous small manufacturers. These latter firms can adjust more rapidly to the changing market demands and technologies. Additionally, Japan maintains a network of research institutes and technology centers that aid and train the workers and firms in new products and processes, enabling them to keep up with the state-of-the-art (Sabel 1984:350). Each example shows a different strategy for utilizing flexibility to aid either large or small manufacturing firms. Other forms of flexible specialization are also operating successfully in places such as the Emilia-Romagna region of Italy and the garment industry in New York City.

Flexible Specialization is a broad concept for manufacturing reorganization that may be implemented under a variety of scenarios, all of which emphasize some form of flexibility under constraints. Flexible Manufacturing Networks are one specific model of this concept. FMNs are groups of competitive small and mid-size firms with certain cooperative business relationships. Within FMN operations, constraints are the individual firms' size and resources, specialization comes in the form of the narrow market niches in which the networks operate, and flexibility occurs with the firms' ability to quickly adjust products and processes to meet global market changes.

The FMN Concept

A Flexible Manufacturing Network, as defined by Richard Hatch of the New Jersey Institute of Technology, is a "coherent system of small and medium-sized firms in which strong commercial linkages have been formed, frequently as a result of sharing essential business, marketing, or technology transfer services" (Italy's Industrial Renaissance 1986:2). These smaller-sized firms, while maintaining their inherent freedom and flexibility in the production process, enjoy the benefits of agglomeration economies by pooling resources, facilities, and services. These firms may be competitors producing similar products, or vertically linked firms, each performing a step in the production process of a finished good.

An FMN consists of a set of firms producing similar products, using similar production processes, or providing factor inputs for one another. While these firms remain competitive with each other, their network creates a form of cooperation. These networks manifest themselves in one of two forms: service-providing networks or facilities-sharing networks. Some networks exhibit characteristics of both. Service networks include business assistance service centers and sectoral service centers, while facilities networks are linkages of firms sharing machinery and equipment that they could not otherwise afford alone. Both types of networks primarily serve manufacturers of finished products, especially small consumer durables, as examples from Europe and the U.S. indicate.

Network structures are built around either vertically or horizontally linked firms. Vertically linked firms are those joined along a processing chain by their production of components or unfinished parts for a common finished good. Through spatial proximity (often in the same building or plant), or sharing product market informa-

tion, marketing, and other services, these firms can reduce their costs, jointly purchase capital equipment, or strengthen their position in the market, to the benefit of all the linked firms. Horizontally linked firms produce competing or similar products, or components for a single large purchaser. While service networks are most prevalent among these horizontally linked firms, facilities networking is also a beneficial, though less common, practice.

Small firms producing similar or identical products can benefit by sharing facilities, technology, consultancy expertise, advertising, or other business practices. These do not inhibit their market competitiveness, though their antagonistic practices may be reduced. Small firms do not have the know-how, expertise, or funds to support many of the manufacturing and business needs to compete in regional and global markets. The case studies described later provide examples of the variety of shared resources in a network.

Industry service centers are critical to the success of Flexible Manufacturing Networks. They can be created independently of existing organizations or can operate within trade associations, universities, state agencies, technical schools, or other non-profit organizations. Network services include activities such as industrial parks around regional service centers, regional business service agencies, low interest loan programs, improvements in vocational and technical training, and assistance in marketing and trade fairs. Among the services these centers provide are sophisticated business assistance; advanced training for and access to state-of-the-art equipment; market research; joint efforts in marketing, purchasing, and export promotion; financial services; and coordinating joint manufacturing ventures. The examples are types of service activities provided by existing regional network policies that encourage the development of small firms, help ensure their future viability, or strengthen their competitive position against larger firms. Successful service center models in Italy suggest that seed capital from public sources may be required to start them, but that in the long run these centers can be self-financing by using membership fees and specific service fees. The willingness of firms to pay for benefits they receive from the centers provides an important measure of accountability and industry control.

The focus of network activity is not on the problems of individual manufacturers, but on the needs of an industry sector as a whole. The service center broker's role is to discover the types of facilities or services that are needed to strengthen the market standing of the industry or industrial district. The activities of the broker include: developing a network strategy, identifying markets and locus of competition, procuring crucial services such as research and development, promoting labor force training, institutionalizing communication, and acting as a facilitator in the creation of network incubators (Hatch 1988c:2). Yet, the first task is to discover a set of firms in an industry that have potential for vertical or horizontal integration through network links, and promote a network relationship around them.

Examining some of the specific functions of a network will help one understand the type of firm or industry subsector that would most benefit from such a development strategy. In Italy, the Trade Association Business Assistance and Enterprise Creation Programs for artisan firms (defined as firms with less than 22 employees) provide the following services (from Italy's Industrial Renaissance 1986:12):

- All general accounting duties for member firms.
- Assistance in the acquisition and construction of industrial parks.
- Organization of management and technical courses.
- Representation of members at trade fairs.
- Assistance in establishing consortia for joint ventures in purchasing, marketing, product design, etc.
- Organization of cooperatives of firms for getting bank financing.
- Assistance in the creation of service centers.
- Group insurance packages.
- Negotiation of contracts with labor unions.
- Consultant and planning assistance to entrepreneurs and new enterprises.

Sebastiano Brusco, an economist at the University of Modena, lists three main contributions of the small firm networks that enable them to stay competitive in a global economy. They are flexibility in the use of man-

power, technologically advanced machinery, and the ability to serve high-end, niche markets. In reference to vertically integrated small firms (decentralized sectors), he states:

The sectors in which decentralization is particularly marked are those in which it is possible to fragment the productive process without having recourse to an inferior technology. This type of industrial structure more than any other fosters the skills and initiative of its entrepreneurs. By using the foresight and imagination of so many artisans, the productive structure is able to offer an extraordinary variety of products which cleverly interpret the needs of consumers and the shifts in their tastes. Finally, the small firm's capacity to develop new products is enhanced both by the proximity of so many entrepreneurs engaged in similar activities and by the extensive collaboration between skilled workers and technicians within the firms (as quoted in Hatch 1987b:6-7).

Benefits of FMNs

The current global economic restructuring has had two major impacts on U.S. regional economies. It has reduced the number of jobs for many skilled assembly-line and manufacturing workers, and has prompted small spin-off firms from the declining large manufacturers. Richard Hatch describes the restructured American industrial landscape:

Since 1979, the Fortune 500 companies have shed fully 3 million workers. Outsourcing is on the rise, vertical integration on the decline. In the seventies, the average U.S. factory employed 650 workers. Today it has 200. New enterprises sprout at the unprecedented rate of 1.1 million a year. Nearly half of the manufacturing labor force now works for firms with fewer than 250 workers. (Hatch 1988a:2)

With the changes in manufacturing, new ways of thinking about American industry in both the private and public sectors will be necessary. The recent increase in the number of small firms makes them vitally important to our economic survival. New ways must be found to insure their survival in the increasingly competitive international economy. These small manufacturing firms need to find a viable market niche in which to compete so as to combat the job losses in their industries. But, these firms cannot realize their full capabilities alone, for acting independently most are unable to compete in the global marketplace.

Flexible Manufacturing Networks have been created out of necessity for two reasons: (1) to encourage the creation, growth, and future prosperity of small manufacturers and (2) to allow existing small firms to compete in national and global markets. Hence, networks strengthen the capabilities of the dynamic and important small firms in manufacturing. In Washington, there is a need to strengthen existing wood products value-added manufacturing and to encourage more of such timber processing efforts. By developing network structures that exploit the comparative advantages of the state in the wood products industry, small processors will be able to survive and compete within the changing global economic structure.

An FMN strategy also helps promote regional self-sufficiency in an industry composed primarily of small firms. Where regional product and technology gaps exist, the network structure will point them out. Missing backward and forward linkages between small firms will become apparent as firms integrate their services and products. The network links the existing knowledge, technology, and accumulated information of the firms, in addition to accessing previously unavailable resources, to enhance all firms' economic position and entrepreneurial capabilities.

FMN facilities and services enable small firms to enjoy the advantages of their size, flexibility, and production processes with the benefit of technologies, expertise, and financial support previously available only to large, sophisticated manufacturers. One author describes three disadvantages of large, vertically integrated manufacturing firms (versus smaller manufacturers): "an inability to respond quickly to competitive changes in international markets; resistance to process innovations that alter the relationship between different stages of the production process; and systematic resistance to the introduction of new products" (Powell 1987:76).

Where large firms, with their large-scale dedicated process machinery, are weak, the smaller firms find their strength. Small firms, using the knowledge, technology, and capital provided by networks, can rapidly adjust their products and processes to meet changing demands and unstable markets. They can also compete in market niches where the production of high value-added and high quality products require timeliness, flexibility in production, and constant innovation. These are areas where small, skilled labor-intensive firms can compete and

prosper. Additionally, a network of firms enables them to aggregate production to fill large-scale (OEM) orders, allows firms to jointly manufacture finished goods or complete components, facilitates producers' shifting to new markets or developing new products, and leads to economies of scale benefits (Hatch 1988b:6). Also, by encouraging creative applications of firms' existing processing knowledge and skills, FMNs help develop new products and markets for the member firms working either individually or jointly.

The newly created or revitalized small manufacturing firms can not only broaden their existing markets, but also must learn how to penetrate new markets. For this, they need help in the marketing and sales of their products. By aiding this process, FMN services provide the capability for the firms to compete, survive, and thrive in new regional, national, and international markets.

Benefits accrued to firms utilizing either service or facilities networks include the ability to aggregate production to service large clients, share business service and research and development investment costs, joint venture to produce finished products and components, and organize joint marketing programs (Hatch 1988c:6). Network member firms often increase their high-wage and skilled technical jobs, entrepreneurial activity, and exports. Regions with extensive FMN activity tend to have more firm start-ups, better industry retention, a stronger business climate, and improved technology transfer. Developers of network models in Italy claim that the networks encourage entrepreneurship, plant modernization, and small firm growth; create skilled and high paying jobs; reduce vulnerability to economic cycles and foreign competition; strengthen backward and forward economic linkages; and utilize advanced technologies.

Robert Friedman, of the Washington D.C. based Corporation for Enterprise Development, further describes these network structures and their benefits:

Underlying the impressive capacity of these small firms is a support system—whose elements seem relatively consistent from region to region—which reduces the weaknesses and builds the strengths of small firms. These support associations of small firms draw most of their funding from their members (though they are often seeded with public funding) to provide accounting, payroll, marketing and other services. Strong training and educational institutions, guided by industry, create a supply of highly skilled craftspeople, knowledgeable in the newest technologies as well as the theory behind them. The local culture begins to identify a new career path: from technical school student to employee to small firm owner. Firms both compete and cooperate; constant interfirm communication is institutionalized. With all of this happening, the whole becomes greater than the sum of the parts.(1987:3)

This structure is also highly dynamic. It enables firms, their relationships, and the network structures to change over time, to incorporate new technologies, to adjust to new market demands, and to face external competition. Thus FMNs, by their very nature are always evolving, and are prepared to confront new economic challenges to help their members prosper.

There is evidence from parts of Europe and North America indicating the ability of FMNs to revitalize slumping industries and economies. Emilia-Romagna in north-central Italy is an archetypal case of intense regional network development over the past two decades. The region has experienced steadily increasing manufacturing employment over that period; exhibits wage rates at 175 percent of the Italian average; has moved, between 1970 and 1985, from 17th to 2nd in per capita income among Italy's 21 regions; and in 1980 the region produced 9.4 percent of the country's foreign exports (Friedman 1987:2). This performance comes from a region where 90 percent of the manufacturing work force is employed in firms with less than twenty-two employees and 39 percent of the total work force is self-employed. This provides the region with one firm for every five people in the labor force, a work force that is highly skilled and utilizes state-of-the-art, computerized equipment in its manufacturing.

There is similar evidence of networks' benefits from other parts of Europe and, more recently, North America. These regions all have different industry structures, economic characteristics, and political histories. What characterizes all the industries in the regions is their network structure, which enhances their economic vitality. They have found an effective policy response to a shifting global economy, increasing competition, and changing market demands.

FMN Case Studies: Europe

Network experiences in Europe provide valuable insights about the characteristics of industries and firms for which FMNs have been most effective and beneficial. Three regions that have utilized FMNs in successfully revitalizing industries or avoiding regional economic disaster are the Jutland in Denmark, Emilia-Romagna in Italy, and Baden-Wurttemberg in West Germany. The decentralization of production and disintegration of large manufacturers into smaller, linked FMNs is most common in those industries with processes that can be fragmented without losing the advantages of economies of scale or resorting to inferior production technology (Italy's Industrial Renaissance 1986:8). Manufactured products produced in the regions include machine tools, motorcycles, electronic controls and machinery, furniture, textiles, ceramic tiles, shoes, and knitwear. This suggests the range of industries for which a network model may be operable. European models also suggest the importance of a geographical clustering of firms, which facilitates the linking of small independent, but related, firms.

Denmark

One type of network strategy is the service center, which provides technological information and know-how to firms in selected industries. In Denmark, this task is accomplished by a "technological services network" composed of two major polytechnic institutes, the Jutland Technological Institute and the College of Technology in Copenhagen, along with 27 other institutes and numerous local information centers (Kring 1987:16). The local centers facilitate the transfer of product and process technology to private industry from the research and development laboratories in the large institutes. These centers ensure that both ends remain at the leading edge of their industries. They also ensure that knowledge reaches firms (particularly the small- and medium-sized companies that represent the bulk of Danish production firms). In addition to their research and development function, the institutes assist the regional vocational centers in training craftspeople and spotting export markets for Danish manufactured products.

A key aspect of this model is that the technical institutes are essentially private, autonomous, non-profit units responsible for their own development and finances. Seventy percent of their funding comes from the companies they serve; the remainder comes from public subsidies for which they are constantly evaluated. The evaluation process forces the institutions to keep their research and information up-to-date and ensure that all firms receive the best advice available (Kring 1987:16). Industries that have been targeted for such network strategies include apparel, agricultural machinery, shoes, construction, metalworking, and wood products.

The Danish furniture manufacturing industry in northern Jutland, a traditional center for the production of wood products, is an example where facilities sharing and marketing networks have been successful. Entering the 1980s, the industry was faced with a slumping demand for its specialty product, "Scandinavian Modern" furniture. The Jutland Technical Institute recommended a strategy to make the Danish industry competitive once again on the world market. To enable the industry to rapidly adjust to the quixotic European market, the regional firms invested, as a group, in computer-aided design tools and state-of-the-art lacquering facilities. These would have been too expensive for any individual firm to purchase. The firms are able to use the common facilities in a cooperative arrangement to meet demand by quickly turning around products from the design stage to the showroom. In another cooperative arrangement, the firms have joined together to develop a catalog through which all their products are sold. By solving common problems with the help of consultants and joint facilities use, these Danish furniture manufacturers were capable of maintaining their craft and their competitiveness within a changing and unstable global market.

Denmark has also been successful implementing FMN structures in its textile manufacturing industry, which employs 30,000 people nationwide. The industry, utilizing new product ranges, niche production, and specialization, now exports over 80% of its output. This success is attributable to a variety of policies initiated by the Federation of Danish Textile Industries, an employers' and trade association, that encouraged the creation of service networks. As stated by the Federation president,

Today we offer both small and large member firms comprehensive service in: labor law, social law, commercial law, export and sales, technology, international and external environment, education, political lobbying activity, and special services (on a fee-for-service basis) in the fields of credit rating information, collection of bills (both national and international), translation, telex, and the like. In the technical field, we have our own institute which assists both individual firms and the trade in general, providing support in the development and adaptation of new technologies (Lundholt 1987:15).

They have also developed vocational training systems and recruiting campaigns in schools to meet industry demand for more highly skilled labor. The Federation encourages firms to share space at trade shows, market information, and export sales consultants.

Italy

Before examining examples of FMNs in the Emilia-Romagna region of Italy, it is instructive to highlight briefly the regional and national policies that have prompted the development of these linked manufacturing firms.

The rise of SME's (small and medium-sized enterprises) in Emilia-Romagna and other regions of the "Third Italy" (central and northeast portion) occurred primarily in rural areas after World War II. The regional conditions that provided the basis for this process were anti-union sentiments, substantial improvements in transport and communications, an abundance of skilled craftsmen, family agricultural plots and support networks that provided a safety net for risk-taking entrepreneurs, and family savings available for investment. These provided opportunity and impetus for the growth of a new type of firm (*Italy's Industrial Renaissance* 1986; Piore and Sabel 1983; Zacchia 1984). The factors that sparked the growth of these new, smaller firms included a decline of agricultural employment resulting in a large number of rural unemployed who preferred to stay put rather than seek work in cities or other regions; numerous returning emigrants with industrial experience who provided an entrepreneurial spirit and acted as agents of change; and greater market demand for a variety of industrial products that could not be provided by the large and rigid older manufacturing firms (Zacchia 1984:113). In addition, the diversification of the product market and creation of quality niches, which can be served better by utilizing flexible production technologies, opened up the opportunity for small, flexible manufacturing firms (*Italy's Industrial Renaissance* 1986:8). While these characteristics are not geographically specific, they existed in abundance in the six-region area of the "Third Italy," and they were necessary and sufficient criteria for the incubation of small, home-based crafts industries. The manufactured products were primarily consumer goods (furniture, shoes and leather products, clothing, and pottery), though there existed a number of capital goods producers, particularly metal fabricants producing small agricultural tools and machinery. Today, these products continue to be the predominant output of the region.

Two service network strategies have emerged in Italy as means for survival of small manufacturing firms. These strategies provide instructive examples.

The city of Carpi, with one-quarter of all Italian output, is the center of the country's knitwear industry (*Italy's Industrial Renaissance* 1986:16). Well over one-third of the total working population of the city is engaged in the industry: 12,000 people work in one of 2,500 knitwear firms. As a result of the international competitive pressure from low-end producers in the 1960s and 1970s, Carpi's industry was forced to restructure itself into smaller, more specialized, flexible firms targeting the high-end of the clothing market. In 1980, the city and CITER (the Center for the Textile Industry in Emilia-Romagna) joined forces to create a knitwear service center to provide member firms with access to marketing, product, and technology information that they needed but were unable to obtain for themselves. CITER also keeps itself up-to-date on industry trends and consumer tastes, while four-fifths of its operating costs are self-financed. The center has proven very successful: the network has produced a highly competitive, regional set of firms in the international knitwear industry, and has created higher employment and wages for Carpi's skilled and flexible work force.

Loan guarantee consortia are used by many Italian industries as a means for firms in cooperatives to mutually guarantee each other's loans and to encourage capital investment by local artisans (Brusco and Righi 1987: 11). By negotiating and guaranteeing the loans, the cooperative is able to obtain them at a low interest rate for its members. The consortia provides financial security to the bank by ensuring the loan repayment, while acting as a credit reviewer of the financial, professional, technical, and social capabilities, and trustworthiness of its members. The strict guidelines applied by the cooperative, and the creation of a social and financial obligation by the artisan to his peers in the consortia, helps ensure the repayment of the loan. The credit cooperative based in Modena, which has been operating since 1976, has only a .7 percent loss rate on the 10 billion lira (\$17.7 million) worth of loans that it has guaranteed (Brusco and Righi 1987:13). This cooperative service network has proven beneficial to the region by encouraging investment and economic growth of small firms in the "Third Italy."

West Germany

The last European FMN example comes from Baden-Wurttemberg in West Germany, which has long been a center for the textile-machine industry. Small, specialized manufacturing firms are not a new phenomenon to

the industry in this region. The regional industrial structure has helped maintain its competitiveness against the large British standardized textile-machine manufacturers since the nineteenth century (Sabel et al. 1987:30). The German firms each produced distinct, highly specialized textile-machines that could not be made with standardized methods employed by the British. In this manner, each firm was able to find its own niche market, and trade associations developed to aid the firms in setting industry standards, marketing, and linking suppliers and customers. Also, marketing agencies, vocational schools, and research institutes to facilitate the transfer of technology were created to ensure the industry's competitiveness (Sabel et al. 1987:31). Recently, the industry has found markets in other manufacturing sectors for which its specialized process knowledge and techniques can be utilized. Presently, private consultants are providing services to many small- and medium-sized firms in the region that they could otherwise not perform on their own. Meanwhile, public sector efforts such as improving institutes for technical education proceed as part of the regional development strategy (Sabel et al. 1987:32).

Although the networking and flexible specialization techniques originated in the textile-machine manufacturing industry, the concept has spread throughout the region. Other industries which also depend on small, specialized manufacturers, employ skilled labor, and use advanced high-tech machinery to make products not associated with high-tech industries include lathe and knitting machine manufacturing.

Clearly, regions need not chase only those industries that produce the latest high technologies. Rather, more traditional industries can be restructured around methods of flexible and specialized manufacturing to help maintain regional economic vitality competitiveness. Such a strategy, rather than stifling innovation, may help engender an entrepreneurial spirit in firms and individuals. As manufacturers become more comfortable with the networking arrangements of this strategy, the networks will grow and change to take on new responsibilities and more sophisticated and complex operations (Friedman 1987:4). As they work within the Flexible Manufacturing Network framework, firms can help define the network relationships and activities that most benefit their needs.

Lessons From Europe

Two points from the above discussion should be highlighted. The first is the emphasis of networks on small-businesses. Over the years, the national and regional governments of Europe have recognized the importance of small to mid-size establishments and the consortia that have developed to represent groups of the smallest firms. As a result of this awareness, many laws, policies, and services have been created to specifically benefit this important sector of the economy. Special exemptions for plants and labor laws for artisan firms have been enacted since 1970, and development aids such as low-cost credit, fiscal incentives, marketing, technology transfer, management and personnel training, are services directed specifically at the smaller manufacturers (Zacchia 1984: 116-20). These policies help combat the economies of scale and other disadvantages of small firms against larger firms.

The second point to be gleaned from the European case studies is that network structures are created as a means to support firms facing a competitive and global market. The policies listed above were implemented to help ensure the international economic competitiveness of the small, independent firms that have become the backbone of the regional economy. It is important to remember that the network policies encourage development of those industries in regions which have a comparative advantage (in resources, skills, knowledge and technology). They also encourage entrepreneurship through new firm formation and technological innovation in the regional industrial specialties.

These points do not constitute a prescription for FMN development for small and medium-sized firms, but provide a framework for understanding the relevant issues, and assessing the feasibility of implementation of network structures in the Washington state wood products industry. The above examination of these examples reveals the importance of introducing networks as a proactive strategy to strengthen a regional industry's global standing, rather than a reaction once economic decline has set in. By examining similar structures in the United States, one can further gain a sense of the importance of a proactive network approach.

FMN Case Studies: U.S.

The Footwear Revitalization Program, begun in 1977 by the U.S. Department of Commerce, is a successful program implemented in this country to help revitalize a sagging mass production industry (Piore and Sabel 1984:303-4). While it is not a true FMN of small firms, the program has many features of a cooperative network structure.

The Commerce Department formed a national group of consultants to identify problems in the footwear industry, and perform studies to develop marketing, training, production, and organizational strategies for the firms in the industry. The program they developed helped individual firms gain government loans, encouraged the sharing of information between retailers and manufacturers to expedite the industry's response to changes in fashion demands, and helped the industry develop new technology to facilitate the response to rapid style changes. And lastly, the American Shoe Center in Philadelphia was created to perform the function of a national technology innovator and disseminator.

There are also regional institutions in the U.S. that have copied the Italian network models. The Local Development Corporation (LDC) of New York is a privately-funded business group that applied the network concept to the metal fabricating and metalworking sector in Brooklyn, New York. They developed an FMN strategy to ensure the economic survival of the industry, which is composed of nearly 100 firms and employs over 3000 people (Hatch 1987:17). While the firms vary in size, each has little influence upon its market, none are quality or cost leaders, and very few maintain patent control. They are primarily small, independent firms facing conditions of perfect competition.

The biggest obstacle faced by the LDC in developing a network structure was transforming the attitudes of the previously independent competitors. The LDC had to encourage firms to recognize the strength of the network system, and to communicate with one another about common problems, sub-contracting agreements, joint ventures, and so on. To this end, the LDC created a directory so each firm in the network could gain familiarity with other firms' experience, capabilities, and needs; created a center to introduce new technologies to firms; and taught strategies to help firms discover new products that they are capable of making, given their current process technology. These programs were all part of an effort to increase each firm's awareness of the industry's markets, materials, and manufacturing processes.

Isolated examples of network strategies can be found in other parts of the U.S., specifically in the Midwest and New England, where policy efforts have been made in Indiana, Michigan, Ohio, Maine and Massachusetts. Yet, the area where the most network energy has been focused is New York City. The knitwear industry in Queens, New York, for example, has been targeted as one industry requiring restructuring to ensure its competitiveness in the world market. This regional industry was selected for FMN development because New York is:

- the largest market for the industry,
- one of the world centers of fashion, and
- the location of the Fashion Institute of Technology (Hatch 1988d:9-10).

The geographic proximity of the manufacturers to the rapidly changing market is a great advantage to the industry. In addition, the industry is growing quickly and developing many specialized niches. The high-margin, private label sector of the industry is the fastest-growing segment. Recent technologies introduced into the industry enable greater flexibility in production processes. The regional industry is composed of 13,000 owners and workers with vast knowledge, experience and potential for the application of an FMN. Through the application of a network strategy similar to that developed in Carpi, this industrial region is expected to strengthen its economic position.

Charles Sabel summed up the potential for FMNs in New York City. He cites the garment district, financial centers, tradition of cooperation between municipal unions and their employers, and the constant influx of immigrants with their entrepreneurial spirit as characteristics from which new industrial economic structures can arise in stagnant sectors (*Italy's Industrial Renaissance* 1986:24). While these characteristics that facilitated industrial restructuring in New York do not exist everywhere, their existence in New York suggests that each region must look toward those characteristics in which it has comparative advantage. This represents a first step in the process of developing regional FMNs for economic revitalization. Those economic advantages that characterize a region should be emphasized in network development. Hence, the entrepreneurial firms, specialized products and processes, and flexible technologies of a region or sector are the key areas upon which to focus. Plus, existing state and regional economic development strategies that promote incubators, technology centers, and the like, can be encouraged and transformed into a Flexible Manufacturing Network strategy.

FMN POTENTIAL IN THE WASHINGTON WOOD PRODUCTS INDUSTRY

Characteristics of FMN Firms, Industries, and Regions

Based upon the theoretical and empirical work in the literature on Flexible Manufacturing Networks, one can identify firm, industry, and regional characteristics that have been significant for network development in Europe and the U.S. For example, in an earlier study by the Northwest Policy Center, it was concluded that firms wishing to succeed within a network structure should:

- Utilize the latest technology and equipment;
- Train and employ a highly skilled work force;
- Specialize in a narrow sector of the market;
- Establish a network of complementary firms to produce finished products;
- Establish a physically and technologically interactive communication network; and
- Be able to recognize and respond to a global market, though regional markets may also be targeted. (Kamimura 1988)

It is difficult to clearly differentiate between characteristics exclusive to firms, industries, or regions. The above are generally firm-level criteria that should exist prior to network implementation, while the following list identifies characteristics of industries and regions after FMNs have been successfully introduced. This list was developed from the discussion in the literature on the qualitative aspects of FMN model industries. Because they are *ex post facto* characteristics, the list does not contain a definitive set of criteria required for successful implementation of FMN strategies, but rather a point of reference to begin an in-depth regional industrial analysis. Existing industries and regions with successful FMNs possess:

- Small- to medium-sized firms.
- No dominant firm or firms.
- Progressive, forward-looking firms.
- History of short-term interfirm contracts and agreements.
- Spatial agglomerations of firms, regionally self-sufficient vis-a-vis inputs.
- Regional backward and forward linkages.
- Complementary products or processes.
- Producers of finished products or complete components, where production processes can be fragmented.
- Producers to a narrow market sector - specialized, non-standardized or 'high-end' products.
- Production of consumer durables.
- Flexible production processes, using state-of-the-art equipment.
- Skilled and flexible (artisan) labor.

The following empirical data from industries and regions with FMNs provides a general range and scale of quantitative measures by which the potential feasibility of networks in Washington state can be assessed.

In the Emilia-Romagna region of Italy, with a population of 4 million in 1980, there are a total of 325,000 registered firms and 1,667,800 persons active in the work force, or 1 firm for every 5 members of the labor force. Plus, Emilia-Romagna has over 90,000 manufacturing firms, 90% of which have less than 99 employees.

The state of Washington, in comparison, had a 1986 population of 4.4 million and boasts 117,922 private establishments with 1,391,415 employees (1 firm for every 12 workers). Washington has 7,047 manufacturing units, of which 92% were in firms with 99 or fewer employees. Although the average firm size for manufac-

turers is significantly higher in Washington than Emilia-Romagna, the large percentage of small- and mid-sized firms is identical.

Other examples of regions that have successfully implemented FMNs include the Queens, New York, where the knitwear industry has about 13,000 workers employed in 450 firms. This averages to a little over 25 employees per firm. With an average firm size of 5, the knitwear industry in Carpi employs 12,000 people in 2500 total firms. The metalworking industry in Brooklyn is composed of nearly 100 firms employing over 3,000 workers with an average firm size of 30 and a range in size from 5 to 60. These empirical examples indicate a regional concentration of very small firms associated with FMNs, which suggests that similarly spatially agglomerated industries composed of very small to medium-sized firms is an important precursor for the application of networks.

The theoretical and empirical conclusions can be translated into a set of quantitative criteria on which to judge those industries most suited for the implementation of FMNs. Regional industries most appropriate and with the greatest potential for success with FMNs tend to exhibit the following characteristics:

- Primarily firms with less than 99 employees.
- No single firm with more than 20% of statewide industry output.
- A county-level concentration of at least 10 firms in a given subsector.

These broad, measurable criteria were used to perform general selection of potential sectors and regions of the wood products industry. Yet, there may exist other, more relevant qualitative criteria that can be used to determine FMN viability in Washington. These are discussed in the following section.

Developing FMNs in Washington

A flexible network of small manufacturing firms need not develop only in response to economic crisis. It is the responsibility of policy-makers in Washington to address the issues and develop solutions before problems reach crisis proportions. By recognizing potential problems and making the necessary adjustments now, the hardship of economic dislocation can be avoided in the future.

Flexible Manufacturing Networks are being analyzed as a potential means to revitalize the Washington wood products industry. Although the industry has rebounded from its slump of the early 1980s, it still faces strong national and international competition. These economic pressures may be combatted with the development of FMNs. Yet, there remain some relevant concerns about the application of FMNs in the Washington economy.

During periods such as the present, when there appears little hope for major change in supply or demand markets in the future, the industry experiences a period of stagnation. In such a period, firms wish to minimize their product, technology, and financial risks. The institution of cooperative networks presents a risk to both the wood products industry and individual firms because it requires new business attitudes, activities, and industrial restructuring to implement.

The foremost concern of policy-makers must be to allay these fears of developing new ways for small firms to do business. Not only must the firms and industry associations provide support to any plan, but the support and trust of public and private development organizations and credit lending institutions must be garnered. For this, all parties must perceive a benefit of FMNs. Fears and suspicions of control of the network by a dominant firm must be overcome. This raises the issue of the state's industrial culture and its willingness to support an arrangement that goes against principles of free market competition. And beyond this, legal restrictions may inhibit the application of the European models. Matthew Coffey, President of the National Tool and Machining Association, has stated that U.S. antitrust laws, along with similar laws that exist in all fifty states, would be violated with the institution of the network models developed in Italy ("U.S. Manufacturers . . ." 1988:7).

Although FMNs are eventually supported by private industry and driven by market incentives, government agencies must provide the initial impetus with policy programs, financial backing, and pilot projects (Piore and Sabel 1984:294; Hatch 1987b:9, 1988b:8). Hatch lists other public actions that can promote attitudes and relationships that initiate the steps toward full-fledged network creation. These include the expansion of subcontracting connections, establishing communication between linked firms, analyzing the production potential of integrated firms, and creating and staffing network service centers to stimulate cooperation and growth of the net-

works (1987b:9-10). The public sector must encourage private support of networks by promoting the idea and providing the initial seed money. In time, the network responsibilities must eventually be taken over by private industry.

In the process of developing FMNs, it may be difficult to determine the best policy direction for the state or local government. One possible government role could be to lay the foundation for a network mindset and infrastructure in a particular industry sector. Other roles are explained in the following:

State and local governments can play three different types of roles in sectorally targeted programs. First, they can act as **brokers**, facilitating productive links among relevant actors in industry, universities, labor and government. Second, they can serve as **catalysts**, using leadership and financial incentives to stimulate private sector actions that strengthen local industry. Third, state and local governments can act as **investors**, investing public funds in activities supporting particular industries, e.g., education and training, venture capital and applied research (Siegel *et al.* 1987:10).

Network strategies are, in essence, a form of sectorally-specific programs. Any public economic development program should pay greater heed to the importance of sectoral specificity in its implementation. These public sector roles and strategies will be elaborated upon in the policy section.

Wood Products Overview

The following discussion will judge the feasibility of Flexible Manufacturing Networks in the Washington wood products industry. Some quantitative characteristics of the state's industries, which might suggest network potential, are reviewed, followed by an assessment of the contemporary economic conditions in the industry that might necessitate and facilitate the development of networks.

Tables 2 through 5 provide a series of comparisons of firm sizes across regions and industries. Just as Emilia-Romagna has a higher concentration of smaller firms than Italy as a whole in manufacturing industries, Washington exhibits a similar concentration when compared to the U.S. Tables 4 and 5 show the even greater significance of smaller firms in the lumber and wood products and furniture and fixtures components of the state wood products industry. These quantitative differences are used to identify the subsectors of the industry upon which the survey research will focus. The detailed study will be able to assess more qualitative industry and firm characteristics.

Within the state of Washington all aspects of the wood products industry are performed. Firms are involved in forest management; logging; milling; lumber and plywood production; shake, shingle, door and window frame, pallet, and piling manufacture; secondary processing for such products as furniture, mobile homes and pre-fabricated buildings; wood treatment; pulp and paper manufacture; and import/export of both logs and processed wood products. While each of the subsectors of the wood products industry fills an important role in the state's economy, the manufacturing sectors, exclusive of pulp and paper processing, were selected for detailed study. These sectors, represented by SIC codes 24 and 25, possess firm and industry characteristics that meet those which state business assistance efforts wish to target, and they most closely exhibit the characteristics of manufacturing industries in which Flexible Manufacturing Networks have been successfully applied.

As suggested in the review and conclusions drawn from the FMN literature, it is the smaller firms with more highly differentiable manufactured products for specialized markets that most benefit from networking strategies. The state has noted a recent interest in targeting its economic development strategies to the small and mid-size manufacturers in key sectors of the state economy. By combining these factors, one finds that network strategy analysis should focus upon the primary and secondary processing sectors of the wood products industry, identified as lumber and wood products (SIC 24, primary processing) and furniture and fixtures (SIC 25, secondary processing). The pulp and paper industry was excluded from consideration because it is composed of a very small number of firms, most of which are extremely large, and does not show any regional clustering.

All subsectors within SICs 24 and 25 were considered as potentially viable candidates for the application of FMNs. Substantial numbers of primary wood products firms exist in several counties, and they show geographic concentrations in most counties in the state. There are far fewer firms in SIC 25, and they are more concentrated in specific counties. This would suggest a limited potential for FMN application for secondary wood products manufacturing. Yet, some of the subsectors in SIC 24, such as pre-fabricated building construction, mobile home construction, and cabinet making, are secondary processors and can be grouped with SIC 25. This

creates substantially more secondary processing firms in the state than initially identified by the simple SIC code breakdown. The regrouping of subsectors is further detailed in the survey analysis and policy options sections of the report.

In addition to the geographic concentration of these sectors, they exhibit a significant proportion of firms in the small to mid-size (less than 100 employees) categories. Similarly, no large firms dominate any of these industries, and only the veneer and plywood subsector has over 20% of total establishments with more than 100 employees.

The prominence of wood products manufacturing in the state economy can be shown by both raw figures and location quotients. Of the approximately 325,000 manufacturing jobs in the state during March of 1988, almost 40,000 were in the primary wood products sector, with an additional 3,900 in secondary processing. While the former has remained fairly constant since recovering from the recent recession, the latter figure has shown a steady increase over time. In addition, wages paid in the first quarter of 1988 were over \$240 million in primary and \$17 million in secondary wood products. The state total for manufacturing was \$2,327 million during the same period. With well over ten percent of the state total in these sectors, the wood products industry is clearly a significant component of the state's economy.

A more startling result is found when measuring the relative number of Washington wood products establishments (or employees) to totals for all state industries, as compared to the same ratio for the U.S. This comparative measure is a location quotient. A location quotient of 1.0 indicates that the proportion of establishments (or employees) in an industry sector, in comparison to all establishments in the state, is the same as the proportion of sectoral establishments to all establishments in the nation. Thus, a location quotient greater than 1.0 means that there are more establishments than would be expected in a sector, given the state's total number of industrial establishments. Table 6, derived from 1986 County Business Patterns, provides data on the number of employees and establishments and location quotients for both SIC 24 and 25 for each county surveyed, for the state, and for the U.S. The location quotient for Washington's primary wood processors by establishment is 2.52 and by employee is 3.03. Clearly, then, SIC 24 is a very significant industry to the state.

In SIC 25, secondary processing, the state has location quotients below 1.0. This indicates that the proportion of the state's industry is smaller than would be expected when compared to the U.S. industry proportion. For establishments, the Washington location quotient is .93, while it is only .425 when measured by number of employees. While the number of establishments is only slightly less than would be expected when compared to the nation, the number of employees is much smaller. This wide variation indicates the much smaller average firm size in secondary processing firms in Washington, compared to the U.S.

The location quotient results indicate that primary wood products processing is much more important to this state than it is to the nation as a whole. The results also indicate that the secondary processing sector is slightly less represented in the state than would be expected, on average. These patterns are significant for the FMN policy analysis later in the report.

Small and medium-sized establishments are common in both sectors. There were 1,598 establishments with 33,284 employees in the primary processing sector (SIC 24) of wood products. This represents an average of just under 21 employees per firm. Secondary processing, a much smaller industry in the state had only 205 establishments and 3,488 employees for an average establishment size of 17. In primary wood products, 65 percent of the establishments have fewer than ten employees, while 59.5 percent of secondary wood processing establishments have fewer than ten employees (Table 5).

Both the primary and secondary wood products industries in the state have experienced fluctuating gross state product (GSP) values over the past two decades (figure 1), according to Washington Department of Trade and Economic Development data. The primary products industry achieved a peak GSP during the boom years of the late 1970s, but has since declined to levels roughly equivalent to that of the late 1960s and early 1970s: the most recent annual figure was \$1.36 billion. Secondary processors have fared slightly better. They have recovered their production levels to \$93 million, commensurate with those of a decade ago, after the recession of the early 1980s. Gross income figures indicate substantial growth in 1987 and 1988, to levels equal or greater than those of the boom years. Although the gross income measure does not differentiate between wood products manufacturing and forestry activities, the consistency between this and GSP over the years would suggest that they are an accurate representation of the very recent trends in the manufacturing portion of the industry.

More significant is the data represented in figures 2 through 5, showing employees, establishments, and productivity rates measured by GSP. These figures also exhibit fluctuations, with little or no net increase over

time. Employment levels in primary processing have been experiencing steady decline since the recession to a 20-year low in 1985. This decline is explained by modernization and improved technology introduced over the past decade that has resulted in greater efficiencies in many of the industries. Yet, productivity per establishment has not increased, and the number of establishments has not dropped substantially, thus suggesting a recent trend of establishment downsizing.

Secondary processors have seen a similar reduction in overall average establishment size, but this is due to a steady increase in number of establishments, achieving a 20-year high in 1985, the most recently reported year. Meanwhile, employment has stabilized after a dip during the recession.

Both sectors have seen average GSP drop steadily as establishments decreased in size. Also, there has been relative stability over the past 10-15 years in primary and secondary GSP per employee. Although technological change is reducing the number of employees needed, it is not producing a greater value of output per employee in either sector. One explanation is that stumpage prices of raw logs are increasing faster than prices of finished products, which means the value-added for products produced by manufacturers is declining.

Although the wood products industry is an important component of the state's economy, these data and the survey results that follow suggest that the industry is neither a dynamic nor growing sector. While technological improvements have been seen in some subsectors, they have not had significant influence on the overall state of the industry. Likewise, production levels, markets, and employment have remained relatively stagnant since the recession of the early 1980s. These conclusions are supported by information garnered from the industry association representatives and individual firm interviews. In general, the industry (especially primary processors) does not appear to desire change, but is more concerned with supply issues rather than market or product change. The industry stasis should not preclude attempts to introduce new development strategies, even those such as networks that require active participation by industry firms, but these factors must be considered when selecting and applying any strategy.

To generalize about wood products manufacturing is difficult and potentially misleading. Processing ranges from undifferentiated, unfinished products to highly specialized finished, custom products. Similarly, some parts of the industry have been using the same processing techniques and technology for years, or have been successful without facing competition or changing markets or marketing. Other subsectors, however, are constantly facing change and having to adjust their products, processes, and strategies accordingly. Plus, issues of international competition, resource supply, and the displacement of labor by technology all have potentially wide-ranging impacts and are relatively new problems being faced by firms not used to change.

With these caveats in mind, the following discussion of industry characteristics, competitiveness, and modernization issues will be generalized to the extent possible, but subsectoral differences will be highlighted where they present significant variations. A sensitivity to these different characteristics of industry subsectors is necessary when analyzing wood products manufacturing and assessing the development strategy options for the industry.

WASHINGTON WOOD PRODUCTS INDUSTRY SURVEY

To determine the feasibility, potential impacts, and internal industry barriers to the development of networks or other state-directed development strategies in the primary and secondary wood products sectors, industry representatives and individual firms were interviewed in Grays Harbor, Lewis, and Spokane counties. The counties were selected for their concentration of firms in SIC's 24 and 25. Grays Harbor and Lewis represent two of the state's counties with the largest number of firms and employees in primary processing, according to 1986 County Business Patterns data. Plus, they are highly dependent on the wood products industry; both have subsector location quotients well above 1.0 (see table 6). Lewis county also has a small number of secondary products producers. Spokane has a substantial number of primary producers, but more importantly, it is the fourth largest county in number of secondary wood product manufacturing establishments; only King, Snohomish, and Pierce counties have more. Although these three Puget Sound counties exhibited some of the largest numbers of firms and employees in both primary and secondary wood processing, they were purposely not surveyed for two reasons. First, the wood products industry represents a much smaller proportion of the counties' total economy by number of establishments, employment, or income standards. Second, the large concentration of manufacturing in the Puget Sound region creates a natural tendency for linkages. The analysis was limited to counties where development strategies would have greater impact or where network potential has not yet been realized.

Survey Methodology and Sample

Five wood products association representatives were interviewed (three on-site, two by telephone): American Plywood Association, Western Pallet Association, Western Wood Products Associations, Northwest Independent Forest Manufacturers, and the Red Cedar Shingle and Handsplit Shake Bureau. They were asked questions regarding the present state of the firms they represent and their industry in general. Topics covered included types of products produced, markets, state of the technology, characteristics of production processes used, and the important competitiveness and modernization issues facing the industry.

The individual firm survey consisted of half-hour phone interviews of randomly selected firms in SIC's 24 and 25 in each of the counties (the appendix contains a copy of the phone survey form). The firm names were garnered from the 1988 Washington State Manufacturer's Register and the 1986 Washington Mill Directory. Interviewees were firm owners, presidents or vice-presidents, managers, and executive assistants. About half the firms received prior written notice of the forthcoming call, but this had no significant impact on the response rate or content of the interview. Table 7 provides information on the survey response rate by county and SIC code. All interviews were performed between April 8 and May 6, 1989.

As table 7 indicates, most firms surveyed fell into the primary products sector, a proportion representative of the statewide breakdown, as the number of firms in SIC 24 far outnumber those in SIC 25 (Table 6). Similar to the statewide firm size averages, the secondary wood processing firms (SIC 25) in the survey were generally smaller than the primary manufacturers. Six of the fourteen secondary producers had less than ten employees and none had more than 100. Only four of the twenty primary producers were in the smallest size category, while six contain more than 100 employees.

The simple division of the wood products industry into primary (SIC 24) and secondary (SIC 25) processing is not completely accurate for distinguishing types of wood processing. To better assess the needs and relevance of FMNs to the industry, a more specific breakdown, taking into account type of product and processing, is required. The following analysis will divide the industry into three components: sawmills and plywood mills, secondary or finished wood products manufacturing, and wood treating and preserving (see table 8). Selection is made on the characteristics of the products (finished versus unfinished) and if the subsector produces cut timber (primary) or if it is fabricating products out of previously processed wood (secondary) (cf. Spencer and Luy 1975:165). The wood treatment subsector is separated from either of the other two because of its intensive use of chemicals, which allies it less closely with the other firms' concerns. According to County Business Patterns data, there were only 15 firms in this latter subsector in Washington in 1986. Although the small number restricts the ability to develop subsectoral specific programs, there is potential for developing linkages with other subsectors both within and outside the wood products industry.

The following analysis of the survey results is broken into four primary components: labor and training, products, markets, and technology. Each is discussed in turn, using the data gained from association and firm interviews, and drawing on relevant survey statistics and additional information, where appropriate. This is fol-

lowed by a discussion of existing collaborative efforts in the industry. Prior to the analysis a brief discussion on sectoral versus regional focus is in order.

Sectoral Focus

Analyzing results by region would not be instructive for understanding the Washington wood products industry. Very few distinguishing differences are apparent among Spokane, Lewis, and Grays Harbor counties in the responses to the interview questions. The variations that do exist, such as differences in market regions and collaboration, are explained by the distinctive differences between the primary and secondary processing sectors. In both Lewis and Grays Harbor counties an overwhelming number of primary manufacturers were surveyed, while Spokane is dominated by secondary manufacturers. The similarity of the responses along sectoral lines indicates that dividing the firms in the industry by sector, and not by region, is the most useful for policy implementation. While sectoral programs may have regional focus (e.g. sawmill strategies will no doubt concentrate in counties such as Lewis, Grays Harbor, and Clallam), any wood products strategy must itself be based on sectoral problems and opportunities.

The survey results showed a positive attitude of the firms toward their regional location in all but one category. In general, there appears to be high satisfaction regarding their location as a place to do business in the wood products industry (figure 6). Only the cost of inputs was ranked as slightly disadvantageous. This was no doubt a response to the issue of resource availability and spiraling costs incurred because of resource limitations. It was this problem that was cited most often as causing the greatest dissatisfaction in the industry. Despite this difficulty, the firms generally felt their business was ideally located in regard to the availability of inputs; especially in Lewis county, near the source of most high-grade Washington timber. Most importantly, both wage rates and work force availability scored very high as advantages to firms' present location.

Labor and Training

Labor and training issues earned mixed reactions by the firms, but in general did not appear to be major concerns. In both the primary and secondary sectors, unskilled labor trained on the job is the most common means of acquiring and developing a work force. Very little formal training, either internal by the company or through external programs, is required by any of the firms. The notable exception is wood treatment plants, which require skilled technicians to handle the chemicals. In general, secondary manufacturing, while highly labor-intensive, has not developed a need for the skilled craftsmen such as are found in Italy or Denmark.

Sawmill labor is organized in a highly structured hierarchy. The common practice is to begin new, unskilled workers on jobs such as sorter or stacker, which require no experience and are at the low end of the pay scale. As individuals gain experience and seniority they move up to more advanced positions, until reaching sawyer status, the most important and highly skilled job in the mill. Skilled sawyers are in high demand, as they represent the key personnel around which the whole production process revolves. The lack of top-notch sawyers was a complaint expressed by both firms and association representatives. Worker loyalty is strong, most likely because (with the exception of the most highly skilled workers) moving to a new mill usually requires that an employee work up the hierarchy again.

Yet, very few firms indicated that they hired only experienced workers, and attracting and training of unskilled workers seemed to be the primary means for filling labor needs. Firms in general, including the secondary manufacturers such as furniture producers, indicated that their main criteria for selecting a new hire is that he or she be willing to work hard and be interested in the craft. This finding may be a function of the type of firm interviewed. The secondary processors tended to have fewer than twenty employees, where the owner or an assistant possessed the design and craftsman skills, which are taught to the employees as needed. Dominant impressions of hiring practices in the industry included informality, with little or no organized training structures, not much aggressiveness in hiring or maintaining skilled workers, and an acceptance of the status quo on these issues. Only the larger mills make highly formalized on-the-job training a standard practice for new employees.

While there were complaints regarding the reliability and loyalty of employees, there were few complaints about the lack of labor with the necessary skills. Hence, labor cost and availability was not a factor in limiting the pursuit of new markets, products, or investments in equipment or facilities. These factors were considered, along with customers, as the least limiting of all factors, as shown by figures 7 and 8.

Firms were universally pleased with the abundance of low-cost labor (Figure 6). Spokane firms generally attributed this to the slumping economy in Eastern Washington, noting that the recent economic resurgence, while good for business, would no doubt reduce the supply and increase the cost of the unskilled labor that many of the firms hire. Lewis county wood products firms, which are part of the major business in the region, have little difficulty attracting unskilled labor looking for mill jobs. As structural unemployment in the wood products industry persists, the supply of workers will remain large.

According to all of these results, it is clear that few benefits would be gained by developing formal job training programs for the wood products industry. The present status of the industries indicates that both primary and secondary manufacturers are capable of meeting their demands with the existing labor supply, skills, and training structures.

Products

The plywood industry appears to use the most modern processes in its production and has been the most innovative in the development of new products to meet competition from other building materials and to enter new markets. Oriented Strand Board is one product experiencing rapid growth in the industry. It is one of a number of manufactured wood products that are being developed to combat the decline in number and quality of wood resources in many parts of the country.

Interview results indicated a distinct lack of new product development by most firms. Those who did experiment with new products were mostly in the secondary products sector, and the products were introduced in response to market demand changes. These instances of innovation were often performed with little knowledge or experience about the market or product promotion, and were therefore extremely risky ventures. Yet, on the whole, firms tended not to be risk-takers, preferring to maintain their production of existing products for existing markets.

One of the major distinctions between primary and secondary producers is that the former's products are not highly differentiable but are sold to distant markets, whereas the latter's products are generally not standardized but marketed primarily in local markets. In both sectors there are under-exploited opportunities for differentiating and customizing the product mix, actions which would increase the value-added of the products.

Washington's Douglas fir and Alder trees are in demand around the world for the production of specialty wood products. For example, Red Alder, formerly considered a weed tree, has been recognized by one former U.S. Forest Service forester as "probably the best species in the Northwest for furniture" (Ramsey 1989). It would be advantageous for the state to develop secondary processing capabilities to utilize these local resources.

Markets

The supply, rather than demand, markets are the major concern in the wood products industry, especially for the primary producers. The closing of old growth timber stands to protect the spotted owl habitat is an all too familiar issue in Washington. Environmentalists and legislators are seen as the culprits preventing the industry from cutting sufficient timber to keep mills open, maintain jobs and competitiveness, and meet the demand for many products. The increasing demand by Japan for old growth logs cut from private and state lands, despite driving up the price of timber, is not perceived as a major problem. The predominant opinion in the industry is that opening up federal old growth stands would provide enough timber for overseas and domestic demands, reduce stumpage costs, and increase jobs. However, many of the subsectors in wood products, primarily secondary manufacturers, are not experiencing resource supply problems, and do not hold this opinion.

Another important issue which calls for federal action is that of foreign competition. The unfair competition cited by firms interviewed entails either foreign government support for uncompetitive firms against advanced U.S. firms, or tariff and non-tariff barriers to the importation of U.S. products. The Japanese housing industry size restrictions and quality control measures, and Canadian shake and shingle subsidies, are the most commonly mentioned barriers to the importation of U.S. wood products to these countries. The associations and firms interviewed also complained that the U.S. government does not provide support for U.S. firms in retaliation to the foreign measures. They also cite the government's unwillingness to negotiate changes in foreign trade practices. These concerns were echoed by many individual firm owners and managers.

Inter-firm competition is perceived not among local firms but on a regional and, more importantly, international basis. This was suggested not only by the associations, but by the individual firms as well. The only exception is the pallet industry, which serves highly localized markets, selling very little out of state, and virtually nothing abroad. The most important competition, perceived mostly by the primary processors, is between nations. The unfair trade practices cited above are felt most strongly by industries where the U.S. producers are trying to break into foreign markets. Washington mills are also facing increased competition in the U.S. from southeastern producers, who have recently begun exploiting their second growth timber.

Another form of competition is with substitute products produced by other industries. This type of competition was recognized, particularly strongly by the shake and shingle and the plywood associations, whose firms compete with firms supplying non-wood substitutes. The wood industries combat this competition by promoting their products as equally safe, reliable, and possessing the additional aesthetic qualities provided by wood.

The plywood association appears to be making the greatest effort at infiltrating foreign markets. The Pacific Rim, where housing starts are steadily rising, was seen as a "major part of the future" for the plywood industry, which can take advantage of this market by supplying inexpensive plywood and structural panels. In addition, the industry is hoping their products will be accepted in the Canadian market after revisions in the Canadian product standards. For sawmills, the Asian market also represents a potential future growth area, but they have had difficulty breaking down trade barriers. The shake and shingle and pallet subsectors remain primarily local or national industries, and sell very little internationally.

At the firm level, there has been surprisingly little growth into or interest in expanding markets to Japan and other Pacific Rim countries. Of the firms indicating that these countries were important or growing markets, all were sawmills (primary manufacturers), with the exception of a single cabinetmaker, who has experienced growth in the Japanese market. This growing market is perceived as potentially beneficial only by the primary wood products manufacturers; secondary manufacturers have yet to recognize its potential.

Based on the results obtained from the survey, firms in the wood products industry, on average, sell less than 30 percent of their output in local or state markets. More than 40 percent of their output is sold in western states, not including Washington. For many firms, California represents a very important market. In the case of one shake manufacturer, all of his product is sold to a single distributor in San Jose. California is also an important market for sawmills and other primary manufacturers. It represents close to 25 percent of their total sales (the majority of products are used in the booming housing industry). On average, about 10 percent of all firms' products are sold overseas, predominantly in the Pacific Rim, especially Japan. Secondary manufacturers sell a large proportion of their product in-state, and in the case of the Spokane firms, in the Pacific Northwest. On average, two-thirds of the output produced by each secondary processor is sold in the Pacific Northwest.

The reason for the contrast between the primary and secondary sectors is explainable. As one of the largest timber producing states, Washington is a major supplier of lumber to all parts of the country and world. But, the secondary manufacture of wood products is not so tied to location. To produce finished products out of lumber does not require proximity to the resource, but rather, is more impacted by labor availability and proximity to market. The latter is especially true in specialty products that are built to meet consumer specifications, such as docks and fences. Hence, Washington secondary manufacturers service primarily local and Northwest markets.

In general, small firms serve local markets in the wood products industries. Of the twelve firms with fewer than ten employees, five indicated selling half or more of their output in-state, whereas only three of nineteen in the 10-99 employment category and none of the largest firms sold at least 50 percent in-state. This difference is expected, especially since there is a greater concentration of smaller firms in the secondary processing sector. Since network strategies find their best application in the mid-sized (10-99 employees) firms, the broad geographic market focus of these firms is a benefit. It indicates that they might not be adverse to developing markets across the U.S. and the world.

From the information available, it would appear that the smaller and the secondary processors are those that need the greatest immediate help with market expansion, while primary producers may need assistance in adjusting to market demand changes as timber species and size availability changes in the future. Developing high quality, differentiated products is a lucrative opportunity for all participants in the primary products sector. The smaller, secondary processors, if they are going to benefit from networking, must be willing and able to expand their markets. As the following discussion indicates, the survey results suggests that they may not be willing or able and that this may be a significant constraint to networking and market development.

Opportunities and interest in product or market growth did not show a trend by region or by type of manufacturer: about two-thirds of the firms in any category expressed some interest. Although there was generally less interest in investing in new equipment or facilities, the response to this question was also fairly evenly distributed across sectors and regions. However, distinctive variation occurred when comparing the responses of firms by size. Firms of less than ten employees overwhelmingly saw little opportunity for either growth or investment possibilities. While all six of the largest firms and 16 of 19 of the mid-size firms saw opportunities for growth, only three of the 12 smallest firms responded affirmatively. This pattern, though striking, is understandable, as smaller firms have little knowledge or access to information about new market or product growth opportunities. Responses to the question of whether firms were pursuing new investments also showed a dichotomy: only 25 percent of the smallest firms indicated that they were undertaking new investments, while more than half of the mid-size and larger companies were currently pursuing investments.

The most distinctive factors limiting the growth and investment opportunities of all firms were the cost of capital (or lack of funding), the availability and cost of raw materials, and economic trends. The ranking of limiting factors are depicted graphically in Figures 7 and 8. Many firms, particularly the smaller ones, felt that they have remained in business due in part to their conservative business practices, especially investment strategies. Unless they have the funds or feel secure in their investments, companies are reticent, especially when facing market fluctuations, to accumulate debt or change product or market strategies. Since their conservatism has served them well in the past, enabling them to survive during difficult times, they continue their pragmatic ways. If new policies are implemented, they must not be introduced as costly or risky ventures for the firms, but opportunities that will not require debt or radical changes for them to benefit. These companies must be eased into changes slowly and must clearly recognize that opportunities exist; they will not risk their money or business on the government's or any other "expert's" advice.

Of the thirty-three firms responding to the question about their strategies of product promotion, fifteen indicated that they used word-of-mouth to sell their products, and fifteen also indicated using trade show or journal advertisements. In addition, thirteen firms indicated that they used the services of distributors or brokers. Trade shows and trade journals exhibited a popularity among secondary producers, and was the only strategy selected by a particular sector. Considering the type of products manufactured by this sector, and the tendency toward greater product differentiation, the use of this technique would be expected. Fully twenty-one of the thirty-three firms use only one or two forms of promotion. The reliance on a limited number of marketing techniques, especially informal ones, does not serve well the objective of market growth or expansion. Yet, marketing constraints were not indicated as a greatly limiting factor in expansion efforts; firms may not be aware of other marketing opportunities. However, firms that did indicate marketing capability restrictions still cited it as a significantly limiting factor. The most common complaint in these instances, especially among the smaller secondary producers, was a lack of time, ability, or knowledge to learn about or pursue opportunities.

Although the significant lack of recognition of, or interest in developing, new markets presents potential barriers to creating policy strategies to pursue markets, the elements of marketing and product promotion that do exist provide potential opportunities for networking strategies. Again, the industry's general informality of product promotion strategies and resistance to radical change must be taken into consideration. Firms that already have expressed a desire to grow, but lack the means or knowledge to do so, would appear to be a logical place to begin encouraging these network strategies. These firms are primarily small (less than twenty employees) secondary manufacturers. Because these firms are in need of assistance and have little time or money to invest in network opportunities, the funding and personnel will have to come externally.

Technology

Each industry sector exhibits a different level of technological advancement from the others, and within each sector, individual firms show a wide disparity in the modernity of their equipment. The association representatives believe that, in general, U.S. firms possess some of the most advanced wood products technology in the world. In truth, this appears to vary by industry and firm. Though some firms may have older equipment that is state-of-the-art, it is only because the technology in the industry has not recently advanced. This is especially true in the shake and shingle industry where process technology has not changed much in decades.

While timber processing remains highly labor-intensive, in the last decade many larger mills have experienced greater productivity per employee with the use of new, faster handling and grading technology. Shake and shingle firms are slow, to a greater degree, to take up new processing technology. This sector has experienced little significant technical change in recent decades. Such innovations as the automatic resaw have not

been widely utilized by firms. The new technologies incorporated into this industry appear to be more in the development of treatment processes and chemicals to make more durable products and in the use of alternate species to replace the declining supply of source wood in the U.S.

While plywood and structural wood products mills are tooled with the capability to produce a variety of shapes and sizes of boards, traditional sawmills in the state are built around the processing of a particular wood source defined by log type and size. As the type of resource used in the production of boards changes, the smaller mills especially cannot afford to do the necessary retooling. The mills that have been able to adopt the new technology to process the small, second growth logs possess the most modern technology in the industry (Tillman 1985:184). Tillman further indicates the need for firms to adopt the advanced technologies to remain competitive, increase efficiency of log use, and reduce processing costs. These measures will likely make conventional mills obsolete. They will be replaced by capital-intensive, high-tech processing units using computers, lasers, and advanced instrumentation, similar to the equipment increasingly being used in other manufacturing industries throughout the U.S. The issue of technology becoming obsolete remains a major concern for the wood products industry.

Collaboration

Much of the collaboration indicated by firms was in the development of special products or in sub-contracting parts of a product being produced. Firms also noted sharing equipment, space, and transportation services. Exactly half the firms indicated that they had participated in some kind of collaborative effort. Though many initially responded 'no' to the question, when examples of joint ventures were mentioned by the interviewer, the firms identified that they had in fact engaged in some collaboration. This would indicate that much of the collaboration is rather informal in nature, often not recognized as collaboration per se, in which local companies swap information and provide assistance when needed. The more formal arrangements cited were made with geographically distant firms and often did not work out, discouraging those companies involved from pursuing other such arrangements. The more informal agreements made periodically under special circumstances were generally more successful.

Not surprisingly, the greatest variation in citing collaborative efforts occurred between different sized firms. Seventy-five percent of the smallest firms indicated having engaged in some form of collaboration, while only one-third of the mid-size and one-sixth of the largest firms responded in the affirmative. Small firms lack the economies of scale to perform all business functions independently, and often require sharing with another local firm equipment, facilities, distribution services, and so on. Naturally, the joint efforts required of firms in networks would be more applicable for these smaller firms, who appear more willing to engage in these kinds of efforts.

From the patterns discussed above, some general rules can be established for a program encouraging networks among these firms. It is important for any network program to present strategies to the companies in a manner sensitive to their concerns. In addition, familiarity in business relations and control over their own destiny are very important concerns to the individual firms; it has benefitted them well in the past, and will keep them in business in the future. These factors must be taken into account.

Among associations, only the shake and shingle bureau indicated an effort to encourage collaboration or linking firms together to improve their economic vitality. This association has performed training for product grade testers and has attempted to coordinate some manufacturers in cooperative arrangements. Yet, generally in the wood products industry, little formal network promotion has occurred. The industry is traditionally composed of strongly independent producers bound to production methods and markets that have been successful in the past. It appears that both the associations and firms need to recognize the necessity for new strategies, new organizational structures, and new ways to compete in the global economy.

A useful model for this type of new program is the Italian wood products trade association, which provides member firms and the general public with information on the technical advantages of wood in consumer goods, research on wood technology, and training in technical aspects of wood products. It appears to act very much as an information clearinghouse on the technical aspects of wood products. Though a large organization (over 2,000 member firms), it is hierarchically structured around specific industry subsectors and product groups. Another feature of the Italian association is its strong effort to reach out to its members, making sure to provide them with the latest training and information that they need.

This aggressiveness is an important component for any such organization in Washington, where most firms tend to be passive in pursuing new opportunities. These firms could use an organization aware of their subsectoral issues and problems, and one willing to continually provide them with global market and product information. Washington has the potential to use its resources and existing organizations to work closely with these firms to develop their products and markets, but the firms (especially the small and mid-size ones) must be reached by the organizations and associations for this potential to be realized.

These issues will be addressed in detail in the following sections on development strategies. But, first, a cautionary note regarding potential obstacles to public sector involvement in wood products small business development.

Each firm was asked to rank, in order, the three most important issues they presently face. The results are depicted in Figure 9. The responses overwhelming indicated that raw material availability or cost and government regulations were the two issues of greatest concern. Note that of all firms indicating resource supply, over 75 percent listed it as the most important issue, while other respondents listed it second, whereas government was the primary issue to only one of the firms. Resource supply concerns were cited most often by primary processors, while secondary firms were more likely to indicate that the government was a significant concern. The displeasure with government intervention, restrictions, and taxes has been a theme presented throughout the analysis.

Many small and mid-size firms expressed a feeling that they are being squashed by government restrictions or, at best, ignored by government programs. Because the blame for most industry problems is placed on the federal or state government, the application of new development strategies is a difficult and sensitive issue. If Washington intends to help develop the industry with policies such as Flexible Manufacturing Networks, the concerns of firms regarding government intervention must be addressed. For example, while the pursuit of international trade as a development strategy (Anderson 1988) would be highly beneficial to many of these smaller firms in the state, most individual firms require special attention to help them find their foreign markets, without being encumbered with numerous regulations.

DEVELOPMENT STRATEGIES IN WASHINGTON AND OTHER STATES

Strategies in Other States

Beginning in the early 1980s, state economic development policy focused on strengthening existing businesses and promoting the growth of new businesses within each state. For example, Massachusetts crafted quasi-public financial institutions to fill capital gaps, created new joint university-industry research and technology transfer programs, and built a base of community development organizations in economically distressed communities. This approach to economic development quickly expanded in industrial states in the Midwest and Mid-Atlantic regions and to the states of the Northwest by the mid-1980s, as it has proven more effective than relying solely upon industrial recruitment.

The most current phase of state economic development policy is characterized by strategically focusing the state's economic development resources. These efforts target small and medium-sized businesses, regional industries and the issues they confront, and provide services to groups of businesses, rather than individual firms. This phase also emphasizes greater use of private resources and increased coordination in providing services to businesses. It is out of these efforts that Flexible Manufacturing Networks have emerged as an economic development strategy.

With the proliferation of development efforts, many states have found themselves bogged down with numerous and fragmented programs operating independently of each other. Economic development is increasingly becoming the business of chambers of commerce, universities, nonprofit organizations, government agencies, and school boards. Tackling the complex obstacles that constrain a state's economic development potential, from inadequate labor force skills to insufficient investment in new research and development, requires effective public-private partnerships, where each actor is positioned to do what it does best, and where all actors function in an integrated system that can effectively address the complex of needs a client presents. To specifically develop FMNs in Washington requires such a coordinated effort.

Characteristics of Strategies

Recently created state economic development programs have several characteristics in common: an increased focus on assisting small and medium-sized businesses, a greater emphasis on addressing regional issues, more use of the private sector to deliver services, an emphasis on coordinated and intensive services to firms, and an increased orientation to group services. These all hint at network structures, as networks have been described earlier in the paper.

State manufacturing assistance programs are increasingly targeting their services to small and medium-sized firms. There appear to be several reasons for this trend. First, states are realizing that small and medium-sized firms lack the resources and expertise to utilize many of the services the states are offering, while larger firms are able to acquire these services on their own. States are also acknowledging the growing share of manufacturing employment found in small and medium-sized firms, and are concerned that without targeting state services such as technology assistance, skill training, and export assistance to these firms, a significant and fast growing component of their manufacturing base may be endangered. States are also more aware of the crucial role that small and medium-sized firms play in maintaining the competitiveness of larger firms by serving as smaller suppliers to these larger firms. Part of the reason smaller firms are growing is that many larger manufacturing firms are increasing their use of suppliers to buffer themselves from market uncertainties.

An example of a state effort specifically targeted to meet the needs of small and medium-sized firms is the Michigan Modernization Service, which provides assistance in the areas of technology assessment, work force training, marketing analysis, labor-management relations, and economic research to manufacturing businesses with fewer than 500 employees. Other similar examples are found in Pennsylvania, Minnesota, and California. This targeting of small and medium-sized manufacturers provides a critical strategic focus that allows these businesses to have a major impact on a state's economy.

States are also turning their attention to addressing issues of manufacturing competitiveness within the context of regional economies. For example, the Massachusetts Industry Action Project, which is part of that state's Industrial Services Program, is designed to improve the competitiveness of key regional industries such as the needle trades in the southeastern part of the state and the machine tool industry in the western part of the state. The Industry Action Project first brings together industry, labor, and community leaders to identify problems facing a key regional industry. After a strategic analysis of the industry has been conducted, specific initiatives

are undertaken. These initiatives may include increasing the range of skills of the work force to enable them to be more adaptable to the industry's needs, investigating new market opportunities for a group of firms, providing technology assistance to meet a particular firm's need, or producing a newsletter on industry trends and information.

Another example of a state moving towards regionally based manufacturing strategies is Pennsylvania, which has recently created nine Industry Resource Centers to assist manufacturers. These centers, sprinkled across the state, operate as the primary service deliverer to local firms in key manufacturing regions. The emphasis on addressing manufacturing issues within the context of regional economies permits state efforts to be more flexible and sensitive to the specific needs of firms within a particular industry.

The direction of state economic development policy is to rely increasingly on private consultants, generally those with engineering, training, and management backgrounds, to deliver services. The role of the public sector in this arrangement is to help with outreach activities and to coordinate and monitor the performance of the private consultants. In addition, several states have built strong economic research components within their agencies to help identify key issues facing manufacturing firms. The most notable research effort is that of the Michigan Modernization Service, which assists small and medium-sized manufacturing firms with technological training, marketing, and economic research services and draws upon the expertise found in Michigan's quasi-public Industrial Technology Institute.

State efforts are also emphasizing coordinated and intensive services to the firms they serve. As states work more closely with small and medium-sized manufacturing firms, they are providing more intensive services such as on-site inspection of the business, detailed recommendations regarding its operation, and on-going consultation. This is the case with the Michigan Modernization Service and the Massachusetts Industrial Services Program, and is the premise of the Pennsylvania Industrial Resource Centers.

Many recently created economic development programs also directly coordinate more than one service. The Michigan Modernization Service, for example, links its intensive technology deployment services with its work force training services by having each business client served by a team. The Massachusetts Industrial Services Program directly links its management consulting services with a high-risk loan fund to help troubled firms. The emphasis on providing intensive and coordinated services to firms helps to meet the full needs of the client in a timely fashion.

Many programs emphasize the use of group services, which stimulate the creation of formal Flexible Manufacturing Networks. Again, Massachusetts has been a leader in this approach with its Industry Action Project and the Bay State Skills Corporation. The Industry Action Project, as noted above, works with a particular regional industry to improve its competitiveness. This focus allows the Industry Action Project to develop group-oriented services, particularly in the area of training and marketing. The Bay State Skills Corporation, meanwhile, generally awards training grants only to consortia of employers working with educational institutions.

Perhaps the most ambitious effort towards group services is the Michigan Modernization Service. It has undertaken a detailed survey of its manufacturing base, focusing on types of technologies used, markets served, and linkages across firms. With this information, the Michigan Modernization Service intends to provide enhanced marketing services to groups of firms based not on what they currently produce, but what they are capable of producing, given their production facilities and skills. The advantages of such group-oriented services are that they leverage limited private sector resources across many firms, help firms learn from each other, develop stronger industry relations and linkages, and initiate the process of developing formal manufacturing networks.

Economic Development Strategies in Washington

Washington's business assistance efforts have attempted to focus on small and medium-sized businesses, emphasize regional manufacturing, utilize the private sector in economic development efforts, coordinate services to businesses, and provide a limited sectoral orientation of its services. The efforts possess some limitations, including fragmented services and a lack of integration between social and economic policy, for Flexible Manufacturing Network development. The state's efforts will be analyzed in light of their applicability to the creation of formal FMNs.

Washington currently offers a wide range of economic development services: education and training, job training, community development, access to low-cost sources of capital, market development, management

training, technical assistance, marketing assistance, information on local sources of goods and services, industry-specific research and development, and technological assistance. These services are provided through a variety of delivery systems, including hotlines, electronic bulletin boards, publications, one-to-one counseling, seminars and workshops, conferences, trade fairs and missions, and short-term training programs. The many separate services and the variety of delivery systems are indicative of a fragmented effort. Furthermore, coordination between the programs and integration of their services appears to be limited. The programs are located in many separate agencies, and no common service retailer exists to provide a single contact for a firm requiring multiple, coordinated services.

There are, however, some examples of formal means of coordination, including the contractual arrangement between the Small Business Development Center and the Department of Trade and Economic Development's Business Assistance Center. In addition, the Agricultural Market Development Advisory Committee ensures coordination between the IMPACT (International Marketing Program for Agricultural Commodities and Trade) Center, the Department of Agriculture's Market Development Program, and the Department of Trade and Economic Development's Investment Division.

The creation of the Department of Trade and Economic Development's Business Assistance Center, in part, reflects a recognition of the need for a clearinghouse - one general source of information on the range of business assistance programs available to small businesses in the state. Implicit within this recognition is the need for coordination between and integration of the business assistance efforts offered by the state. This integration could develop further if the Business Assistance Center or its designated agents became true retailers, accessing services from other agencies or private sector vendors, and providing an integrated, customized package of services to small businesses.

These existing public sector business assistance services, with some modifications, could act as building blocks to the development of networks in Washington industries. The following sections review the various components of the state's efforts.

Small and Medium-Sized Business Emphasis

Washington's business assistance programs have increasingly focused their efforts on assisting small and medium-sized businesses. This focus recognizes the importance of smaller firms to job creation and retention and the state's economy in general. Among the several Washington state programs having a small-business orientation are the Small Business Development Center, the Washington Development Finance Authority, the Development Loan Fund, and the Export Assistance Center of Washington.

The Small Business Development Center, which is headquartered at Washington State University and has subcenters throughout the state, provides small-business managers and owners with the skills and resources needed to develop their businesses. Services provided by the Small Business Development Center include: one-to-one counseling, educational programs, and research into general and technical problems facing small businesses.

The Washington Development Finance Authority, created by the Washington State Legislature in 1989, provides a source of lower-cost capital to those businesses generally having restricted access to capital, including small businesses and those involved in older, traditional industries. Under the program, the Washington Development Finance Authority pools the needs of participating small businesses and sells bonds backed by the pool.

The Department of Community Development's Development Loan Fund provides another source of capital for small businesses in economically distressed areas of the state. The amount of the loan is the difference between the total project cost and the level of private financing and equity available. In most cases, public participation is at interest rates substantially below market rates.

The Export Assistance Center of Washington encourages exports by small and medium-sized companies in the state by providing assistance on the mechanics and financing of exports. Recognizing that these companies face a number of obstacles in exporting their products, including lack of information about export opportunities and financing alternatives, the Export Assistance Center includes among its services a computerized export counseling system designed to diagnose a company's export information needs, review actual transactions, and prepare loan proposals and strategic plans; and assistance securing export financing.

Regional Focus

Over time, more of the state's economic development efforts have taken on a sub-state, regional focus. The primary vehicles for regional development services are the marketplace programs, the economic development councils and associate development organizations, community colleges and their targeted training programs, and informal industrial extension programs emerging at the state's regional universities. Yet, the successful implementation of Flexible Manufacturing Networks requires increased coordination of these efforts.

The 33 associate development organizations also provide key services within the panoply of the state's regional economic development strategies. Working with local chambers of commerce, visitors bureaus, the Joint Training Partnership Act (JTPA) Private Industry Councils, educational institutions, port districts, local governments, and other economic development programs, these associate development organizations promote the area's economic development by providing assistance with financing, marketing, planning, and accessing state economic development and community development resources; counseling business clients; providing training and workshops; and disseminating information on the local labor market and industrial sites.

Private Sector Service Deliverers

The Washington Technology Center, designed to create advanced technologies of benefit to industry and to shorten the period of time between their discovery in the laboratory and their practical application in the marketplace, is required to match its state general fund support with gifts, grants, and contracts from outside sources, including industry support. In addition, intellectual properties, inventions, and processes created by the Washington Technology Center are licensed and transferred to businesses capable of creating a commercial success from their application. Research conducted by the center has resulted in the creation of a number of area businesses.

Businesses are also an integral part of the Job Skills program, which is designed to create new jobs or save existing ones by providing short-term, job specific training to meet the needs of local businesses. Under the program, a business identifies its short-term training needs and selects an education or training institution to provide the training. Together the firm and the institution develop a customized training program, the costs of which are covered by state grants matched by business support, in cash or in-kind contributions. Training program participants are recruited with the assistance of the Employment Security Department and the Private Industry Council and then selected by the business. Upon completion of the training program, participants are hired by the business.

Coordinated and Group-based Service Provision

A few of Washington's business assistance programs use a coordinated approach in the delivery of their services to businesses. The Small Business Development Center, in providing counseling to small-business managers and owners, identifies the problems they have, works to resolve those problems within the scope of their mission, and refers those clients with other problems to other public and private business assistance programs. The Marketplace program, in working with local businesses to find local buyers and suppliers, is also aware of the range of problems and opportunities faced by these businesses and the services they need. The same is true for the local economic development councils and associate development organizations, which, in addition to providing services directly, are designed to provide businesses assistance in accessing state economic development and community development resources.

In addition, programs such as the Department of Community Development's Community Revitalization Team and the Department of Trade and Economic Development's Business and Job Retention Program embody provide coordinated and intensive services. The focus of their efforts, though, are economically distressed communities, not individual businesses or industry sectors. Highly coordinated and intensive business assistance services have yet to be developed as part of Washington's economic development strategy.

Washington's 21 agricultural commodity commissions, which date back to the 1930s, are the state's oldest examples of programs providing group-based services. They are composed of agricultural and food processor representatives, and are responsible for marketing and promoting the products, conducting research and development projects, undertaking consumer education campaigns, investigating unfair trade practices, improving grades and standards, and disseminating information to the industry. They are funded through assessments levied on products sold.

In the mid-1980s, the Washington State Legislature created two sector-specific research centers to conduct research on the issues limiting the export of their products, and to disseminate their results to those in the industry, other researchers, and government agencies. They are the Center for International Trade in Forest Products (CINTRAFOR) and International Marketing Program for Agricultural Commodities and Trade (IMPACT).

CINTRAFOR, established as a part of the College of Forest Resources at the University of Washington, identifies opportunities for, and addresses problems relating to, the export and import of wood products. It does this by collecting statistical data on forest products and international trade; conducting research on specific problems and opportunities in the international trade of forest products; developing technology needed to manufacture products for the international market; and disseminating information on world trade in forest products through seminars, conferences, workshops, and publications.

The IMPACT Center, established as part of the College of Agriculture and Home Economics at Washington State University, seeks to improve the export market for Washington agricultural and food products through the application of science and technology. The IMPACT Center's activities fall into three broad areas: discovery of new or expanded market opportunities for Washington agricultural and food products; solutions to technical impediments to exporting agricultural products; and development of new agricultural products for sale in export markets.

Local economic development councils and associate development organizations are in a position to provide group-based services as well. The Economic Development Board for Tacoma-Pierce County, for example, has undertaken a series of targeted industries studies to determine the importance of these industries to the local area and the issues they confront. The results of these studies, which focus on the food, wood, and plastics sectors, could well provide the basis for developing Flexible Manufacturing Networks and other group-based approaches to the delivery of business assistance services.

Washington's business assistance efforts have many characteristics that would be conducive to the creation of formation of FMNs in the wood products or other industries. The state has an array of programs designed to meet the needs of small businesses, including one-to-one counseling services, educational programs, research and technical assistance, sources of low-cost capital, export assistance, and technology transfer assistance. Additionally, private sector involvement in the state's business assistance efforts has grown, and includes financed programs, general financial support, referrals to and from business assistance programs, and industry and labor representation on the governing boards of state programs. The needs of groups of firms, particularly those in regionally important industrial sectors, are addressed by groups such as the state's agricultural commodity commissions, the IMPACT Center, and CINTRAFOR.

The range and orientation of state economic development programs exhibit properties that can compose the foundation for network building. Such characteristics as a small-firm focus, utilizing the private sector, and serving all variety of a firm's needs by a single provider all presently exist. A more concentrated and sectorally-focussed effort still needs to be developed, with additional strategies directed toward linking firms together and providing better outreach by the service providers. The result would be more effective state services to small businesses in specific sectors, and an identification, by firms in a sector, of the sector as a unified entity with common opportunities and problems.

WASHINGTON POLICY ISSUES AND OPTIONS

Introduction

This section extends the review of existing Washington business assistance strategies and provides suggestions for their improvement through the creation and utilization of industry service organizations that can promote network activity. The economic development policy options outlined below would result in improved competitiveness, personal income gains, and more rapid job generation in Washington's wood products and other industries. These policies would achieve these ultimate ends through market-driven programs to accomplish the adoption of advanced product development, technology, and marketing processes. By enhancing the competitiveness of small firms in these ways, the state will encourage their more rapid growth, generating more jobs and higher rates of growth of personal income per capita.

The recommendations about potential Washington economic development strategies come from an analysis performed by the Northwest Policy Center (NPC) on the Washington wood products, food products, and metal manufacturing industries and an extensive NPC review of policy models from other states and countries. A more complete discussion on all three sectors and detailed policy analysis is found in the NPC report, "Forging Sectoral Linkages" (1989).

The following recommendations are at two levels of abstraction. There are a set of general, high-level recommendations concerning the general architecture of economic development programs in the state, and other, more specific recommendations pertaining to particular network development policies and strategies. If the relationships among programs are strengthened while at the same time sector-specific, industry-driven efforts are started to develop network activities, a potentially powerful, dynamic engine for sectoral-specific economic progress will be created.

The Architecture of Economic Development

As exhibited in the review of existing state efforts, the state currently supports a wide-ranging economic development effort. Washington has programs for industrial recruitment, entrepreneurial training, labor training, financing of infrastructure, business loan packaging, export marketing, import substitution, and resolution of technological problems. However, there are several serious problems with these programs that limit their applicability to network creation in the wood products industry: they are scattered widely across different agencies, each with its own sources of funding and clientele; outside of the commodity commissions, there is little sectoral focus - firms from all industrial and service sectors are served by most of these programs; and few of these programs achieve significant penetration of the state's large population of small and medium-sized firms.

The present business assistance effort in Washington presents a variety of different service providers marketing their wares to the busy small-business owner or manager. The latter are so focused on day-to-day problems that there is little time to investigate the confusing array of services offered by the state. As a consequence, little help is sought from these sources. Low utilization rates are in part a direct consequence of the fragmentation of the state's economic development efforts.

The existing programs would have a greater impact on the wood products industry if they became more integrated, and thus better prepared to assist businesses with their problems and opportunities on a sectoral basis. Integration can also create critical linkages to address the real problems and opportunities faced by wood products and other Washington industries. Resolving these problems of inadequate integration and low utilization will require a re-orientation of the programs and retraining of some of the programs' personnel. In addition, a set of entities with strong sectoral orientations must be created to complement these more generic efforts.

The following discussion addresses the problem of integrating the generic or "horizontal" efforts through a strengthened and refocused field agent system, followed by a discussion of the creation of sectorally-oriented efforts. Together these strategies comprise a framework for the creation of directed network-forming efforts.

Field Agents for Existing Services

It is difficult to integrate existing programs which now separately retail their services to small businesses, yet it is crucial to the success of the state's economic development efforts that this be accomplished so that natural complementarities among programs can be exploited and duplication of marketing efforts avoided. Typical

small businesses have a complex set of problems which restricts their growth or hampers their competitiveness. A more integrated development effort can attack all of a firm's problems at once with far greater effectiveness than the individual efforts of several separate programs having narrow mandates.

To integrate existing programs, to focus effort on the problems of small and medium-sized businesses, and to encourage flexible network formation, the state needs appropriately trained field agents to influence both small business and service provider behavior. New or existing networks of field agents who are in daily contact with small businesses should be utilized as "sales officers" for the service programs such as DTED's International Trade Division, the Export Assistance Center, and the Washington Technology Center. The field agents need to have the appropriate skills to diagnose problems and spot opportunities for the state's small businesses, as well as the knowledge and confidence of the service programs they represent. The goal is for these programs to rely on the field agents, rather than creating their own direct linkages to businesses. Creating these capabilities through a field agent cadre would require central staff support systems, changes in the fiscal operations of both the field agent and service organizations, and a comprehensive training program.

The new fiscal approach provides an element of accountability that does not presently exist, and it fits with the strategy of encouraging businesses to demonstrate their own commitment to the programs by putting some of their own funds into the effort.

Fiscal Operations

To increase business interest in using these services, as well as the responsiveness of the service providers to business needs, the state could provide field agents with a budget to pay part of the costs of using business services provided at the state level. If budget power resides with the field agents, and service providers must justify their existence by earning at least part of their budget on a fee-for-service basis, the desired integration of field agent and service provider will quickly develop, and it will encourage greater service outreach to the firms.

In addition, the business receiving the service should pay at least part of its cost through a service fee as well. The business demonstrates its interest in and commitment to the activity in this way, while also gaining some control over the character and quality of the service. It is absolutely crucial that the private sector, in time, become a more important determinant of the range and character of services provided by public economic development programs. Unless these programs are responsive to real business needs, as visibly demonstrated by the willingness of small business owners to contribute to the cost of the programs, then they will never have more than a marginal effect on the vitality of the state economy.

A public subsidy is needed, at least in the early years of this program, to gain the interest of small business owners who are skeptical about the benefits of government policy intervention and have little capital to risk on a new and unproven program. Until the program is capable of producing case examples to show its success, the subsidy will be required. This subsidy is a means by which the barrier of fiscal conservatism in business practices can be overcome.

Field Agent Training

Candidates for the role of field agents, who will act as brokers between small businesses and service programs, include the staff of several existing public or public-private programs, such as: Small Business Development Center, cooperative extension agents, Associate Development Organization, and the Marketplace program. In addition, selected private sector organizations such as commercial loan officers, accountants, and consultants may also have a role to play.

Each of these candidate field agents comes from an existing program or firm which has its own mission and ways of interacting with small business owners. To serve effectively in their new role of field agent, they will need to participate in a training program to give them a common vision and set of tools. To that end, the state must establish a field agent training program.

Following the model now in use in Denmark, the field agent training program could consist of several sessions covering such topics as: how to do industry or subsector studies; how to run focus groups to get industry groups to reveal and discuss subsector-level capabilities, problems, and opportunities; how to assess markets for the production capabilities (not the current products) of a subsector; and how to conduct subsector strategic planning. Each session would provide some new tools to the participants, which would then be utilized in field exercises between sessions. In addition, part of each session would consist of briefings on the services offered by such organizations as the International Trade Division of the Department of Trade and Economic Develop-

ment, the finance programs of the Department of Community Development, and the Washington Technology Center. The new fiscal mechanism for subsidizing the services of these programs through contracts between them and the clients of the field agents would also be explained.

Following the training sessions, field agents could begin to practice their craft in state industry sectors, such as primary and secondary wood products manufacturing. Referrals to existing public or private service providers would result from the interaction of these agents with small businesses. Over time, their activities would foster stronger links between business assistance and technology programs. By focusing field agent efforts on industry sectors, not just individual firms, a more strategic and integrated economic development effort would emerge.

A continuing education program will help to build a sectoral orientation and a more professional capability among the field agents over time. It is likely that such an effort will include in-depth exposure to current and emerging technologies in each major subsector in the wood products sector in which a particular field agent specializes. Thus, a successful and continuing program must be tailored to small groups of agents within each subsector specialization. Part of the state's budget contribution should be used to ensure that the agents receive two to four weeks of continuing education every year.

Building a Sectoral Orientation

A more integrated horizontal development effort is only part of the solution to Washington's economic development problems. To be truly effective, economic development efforts need to have a far stronger sectoral orientation, such as those provided by FMNs. To offer all Washington industries the same management counseling or export assistance program (as the present system does) is to ensure an extremely limited domain for the program. In this latter scenario, management counseling is provided only for start-ups and export assistance is given only to those attempting to export for the first time. The model of limited outside intervention is no longer appropriate in an industry experiencing increasing national and international competition, rapidly changing resource supplies, and technological change. The need for a strengthened sectoral focus was recognized by the 1989 Washington State Legislature, which provided funding for a senior-level staff position in the Department of Trade and Economic Development devoted to wood products issues. To keep the small firms competitive we must take additional steps to ensure that state-of-the-art technology, product development, and marketing practices are adopted widely within the state's industry. Industry-controlled, sector-specific service centers are the key to achieving and maintaining competitiveness.

Industry Service Centers

Upon the completion of the field agent training program, the state will have a cadre of field agents oriented toward their particular sector. They will be organizing groups of firms in wood products to act jointly on their common problems and opportunities. A natural next step would be to form service centers for each sector. These service centers could work on problems or opportunities important to firms in the sector. For example, in the primary wood products manufacturing sector, coping with reduced wood supplies is currently a significant problem. In addition, developing the current small secondary processing industry into a significant subsector in Washington may be an important opportunity for secondary manufacturing firms.

While outside analysts can define industry problems and opportunities, it is crucial that the identification of problems and opportunities come from within each sector, and that the firms in the sector be firmly in control of whatever actions are taken. Without this sectoral delineation of the issues, any efforts to organize service centers to deal with them are doomed. The best way to ensure that sectors have a part in defining their plight and opportunities is to make service centers industry-owned and industry-operated. However, to get them started will require some seed capital from the public sector, and a sense of vision and leadership as well.

A starting point for this program could be a series of sector-specific conferences to encourage business owners to think about issues confronting the wood products sectors, rather than those facing their own small firms. From such conferences, firms would develop perceptions of common problems and opportunities, which may lead to further collaborative efforts. From those initial collaborative steps, full-blown industry service centers could eventually emerge, given the proper leadership and support from the state.

Each service center will have a unique function within the sector it represents. Marketing programs might be the focus of one center, while another might work on technological problems or product testing. Each center's function would come from industry-led efforts to define common problems or opportunities, and industry-sup-

ported and industry-financed efforts to develop strategies for addressing these problems and opportunities. The public role in the creation of such centers is to provide seed capital, a sense of vision, and overall leadership of the effort. A strong public role will be needed in the creation of the first one or two service centers, but as their success becomes evident, businesses will be more likely to engage in the creation of centers to serve their sectors.

Existing organizations have a role to play in the creation of service centers. While some of the current public service programs could evolve into service centers, testing and marketing activities of some industrial associations make them resemble these service centers. The wood treatment programs and inspection services provided by the Red Cedar Shingle and Handsplit Shake Association are indicative of the types of services that a service center might offer. This is also the case with the research and development and marketing services offered by the American Plywood Association. These organizations may serve as models for other subsectors which have identified common problems or opportunities that a sectoral organization could tackle. Each sector will have to decide for itself whether to graft new activities onto an existing organization or to create an entirely new organization. Over time these workshops and evolving service centers could become major forces for modifying and strengthening existing public and private business assistance efforts, and drivers for the creation of new, sectorally focused programs such as Flexible Manufacturing Networks.

Having trained field agents ready to work with firms during sector workshops is the key to ensure the implementation of ideas generated at the workshops. Field agents who have undergone the training program described above are the ideal force to implement sectoral strategies. They will already be trained to think and operate at a sector level, and they will also have the skills and budgets to provide technological, training, and marketing services to firms from centralized state programs. Thus, the horizontal and vertical aspects of the recommendations are critical to each other's success. The architecture of the whole system is as important as the design of any specific element of the system.

The field agents and the sectoral workshops are both keys to encouraging small firms to think of themselves as members of sectors and subsectors facing common problems and opportunities. By acting as members of sectoral groups, i.e. networks, these firms can address problems and take on challenges that are too big or complex for any individual firm to tackle. Networks in Europe have demonstrated the capacity to win contracts for very large projects and to overcome significant quality control and technological modernization challenges. These networked firms are no less interested in the independence a small firm provides, but they have found a key to greater achievement in selective cooperation with other firms. That capacity can be created in Washington wood products through the relationships between small firms and service providers envisioned in this report. Small businesses can only acquire a more central role in the economy by linking up with other firms and service providers to improve their products, processes, and marketing efforts.

Monitoring Long Term Trends

Monitoring long term trends in technology, products, and markets is a critical subsector effort, and one that can be efficiently operated at a subsector, rather than individual firm, level. As noted earlier, macroeconomic forces at a national and global level are increasingly affecting the fortunes of the state's large and small businesses. These powerful forces must be monitored and interpreted for their impact on businesses in particular subsectors.

In part, it is the job of every small business owner to interpret external conditions and decide what they mean for that particular enterprise. Yet much of the monitoring and interpreting can be performed more efficiently by a small number of professional service providers. The subsector market analyses carried out by field agents are a first step in this monitoring effort. Over time, attention must be given to how this monitoring effort is maintained, improved, and tailored to the needs of firms in that subsector. CINTRAFOR is perhaps the best example of this sort of monitoring currently in Washington's public sector. Such programs, paid for and guided largely by industry in the long run, are essential to the long term health of small business in Washington.

Industry-level long term monitoring efforts must be included in the training at the workshops, and that initial steps to fund such monitoring efforts be taken by the public sector. As the worth of these early subsidized efforts is proven to firms in a sector, they should be turned over to the private sector.

Sectoral Strategies for the Wood Products Industry

General Strategy Requirements

Minimally, industry sectoral strategies must be differentiated between the primary and secondary manufacturing sectors, and ideally identified at finer levels of distinction. The latter may occur over time as field agents and service centers develop knowledge and competence working in the industry.

The survey results suggest that important sectoral and subsectoral differences exist in the wood products industry, differences that state programs fail to address. Meanwhile, the state possesses comparative advantage in the wood products industry due to its resource quality and supply, an experienced wood products work force, and a developed transportation system for moving the commodities. In addition, other industry characteristics that might prove beneficial when developing sectoral strategies include excess plant capacities, organizations and associations interested in and familiar with product exporting, and an excellent geographic location for exporting to the growing Pacific Rim markets (Anderson 1988:226).

The fiscally conservative characteristic of primary producers should be built upon as a strength rather than a hindrance to development strategies. State policies cannot depend upon financial investment by the firms until they are proven to be secure and beneficial for the firms. Industry-driven strategies can be promoted by the agents and service centers with financial help from the government until their success is proven, at which point the fiscal responsibility can be increasingly assumed by the private sector.

A primary objective of any policy action in the wood products industry must be to overcome perceptions that, in all too many instances, preclude a desire for growth or change. A positive attitude toward change is necessary for firms facing the global economy that do not want to become a casualty of that change. Critical masses must be formed of dynamic firms that represent distinct subsectors facing common external challenges. These groups can be found in both the primary and secondary sectors of the industry. Sectorally linked networks will enable the industry as a whole to become proactive, rather than just reactive or inactive, in the face of change.

The sectoral outreach duties of the field agents and service centers cannot be overemphasized. Many firms have neither the time, knowledge, nor interest in utilizing state-supported programs available to them. Any new strategy developed must have the human, financial, and informational resources to inform and encourage firms to utilize their services. Trade associations have shown an ability to provide their members with information and services. Washington state can and must do the same thing. Given the lack of capital indicated by many smaller firms, an outreach effort in this area of business assistance would prove especially beneficial. As suggested above, all of these efforts will require substantial retraining and new thinking by existing business assistance providers. The recommended service center structure provides the foundation on which new sectoral linkages, attitudes, and strategies can be built.

Strategies for Primary and Secondary Manufacturers

One policy for the primary manufacturing sectors of the wood products industry is to encourage the development and utilization of more modern, flexible technologies. Such technologies would be able to cut the greatest possible variety of logs and employ advanced materials handling and grading techniques. The smaller mills have been unable to purchase and employ the most advanced technologies currently available; policies must be implemented to provide the information, training, and financial support needed to bring them up-to-date. If encouraged to look toward new technology, products, and markets, and away from supply concerns, these firms can improve their chances of surviving the supply crisis and find new competitive niches. With the lack of such strategies (even without the distraction of the spotted owl controversy) many of these firms will disappear as advanced technologies and foreign competition undercut their traditional market. The funding and initial effort for economic revitalization must come from sources external to the firms. Policies implemented within the Flexible Manufacturing Network framework will create a structure in which the firms can share the costs over time.

Montrey and Johnson (1988) emphasize the importance of effective utilization of new technology in maintaining a strong wood products industry in the context of changing resource availability. They list several opportunities to do this, some of which are presently being pursued by firms or their associations. One opportunity that has not yet been applied in Washington is the "increased componentizing and off-site manufacturing in house and building construction" (Montrey and Johnson 1988:121). This form of pre-built home construction has been used extensively in Scandinavian countries to reduce construction costs and resource wastage because boards are cut to size at the mill site as needed and used directly in construction. This type of manufacturing re-

quires joining together the processes of milling and construction, which traditionally have been separated in the U.S., even in the pre-built structures industry. It would require extensive firm networking and capital funding to be successful.

There appear to be no major barriers to attempting this sort of practice in Washington, though it may be successful only in the Puget Sound housing market, where shipping distance and costs can be minimized. Although the Washington industry supplies substantial lumber, shakes and shingles, and window and door frames for the California housing industry, transportation costs may be a barrier to the construction of pre-built homes in Washington for the California market. However, Scandinavian firms are now marketing manufactured homes, shipped by container and erected on-site in Japan. This example demonstrates that with the right product and good marketing, firms can overcome transportation cost disadvantages.

The potential to market Washington state lumber as desirable, high quality lumber may enable a degree of product differentiation in primary processing. Many of the firms and association representatives indicated the worldwide demand for Washington lumber, which is known for its consistently high quality and strength. Douglas fir and Alder, which are in demand around the world, are two species that could be developed for such efforts.

Through marketing ventures that stress the quality characteristics of the lumber, Washington primary producers, who already sell worldwide, would have the capability to improve their market hold and obtain higher prices for their products. In addition, marketing new, high quality products such as Machine Stress Graded lumber would reinforce the already established quality image of Washington lumber. As a demand-oriented strategy, this does not aid in the supply problems with which these firms are concerned, but it puts them at a very strong position *vis a vis* their markets.

Although many mills indicated the popularity of Washington wood species in markets across the globe, little secondary processing utilizing these species has emerged. The manufacturers could benefit by emphasizing the quality wood used in their products; such strategies stressing regional resource quality have been used in promoting Washington apples, California raisins, and Colombian coffee. Presently, raw logs or rough cut boards are exported to European furniture firms, while at least one Illinois firm has developed a European market for furniture components. Washington firms could be building the furniture, or at a minimum constructing the component pieces for the Italians and others to assemble. The furniture industry in California and in the Southeast may be potential markets for furniture components as well.

One valuable lesson from Europe that can be applied to Washington's wood products industry is the importance of high quality products. In Denmark and Italy, firm managers, association executives and service center staff stress that high quality products are the source of their competitive advantage. Secondary statistics and casual observation of these economies also suggests a high degree of affluence derived from a specialization in the high end of each market. Profit margins and wages are likely to be higher than in the more commodity-oriented, price-conscious markets in which many of Washington's wood products companies compete. Technologically backward, manual production processes can be sustained in some subsectors, such as high fashion furniture in Italy, precisely because of the high quality and high margin business niche these firms have found for themselves. In other subsectors, higher-volume production processes are used, with more advanced technology, but the emphasis on quality is still maintained, and the markets are still towards the high end of the spectrum. High quality production is not just a strategy for reducing rework and getting a higher price for existing products. More importantly, an emphasis on higher quality, differentiated products, aimed at particular high margin market niches, is a key to higher wages, profits, and continued economic strength in the Washington wood products industry.

High-value secondary wood products that emphasize quality over cost exhibit one potential direction for Washington secondary processors, if the products are made with local wood species. Finished products made from Washington timber have exceptional potential as a specialty, high quality product. One Lewis county furniture manufacturer has experienced tremendous demand for its styles, made from Northwest woods. They have benefitted from the production of quality products that fill a new market niche, a strategy others could emulate. The small size and local market orientation of most secondary processors suggest that significant development of the sector will require public and private leadership, new entrepreneurial resources, and a special development program at the state level. Yet, it appears that it would be advantageous for Washington to develop secondary processing capabilities, utilizing the state's resource strength as a national and international marketing tactic.

In addition, secondary manufacturers require assistance in finding and filling national and global markets. Although the desire exists, firms who currently possess marketable products have been unable to spend the time or money to develop the necessary knowledge and expertise by themselves. New state development strategies can help provide these skills for them. The service centers will also be able to perform research and have an understanding of global trends that can improve the capability for Washington firms to find and develop specialty markets and value-added products.

In developing secondary wood products manufacturing, not only are strategies based upon a particular natural resource helpful, but utilizing an existing skill or technology prevalent in the state's industry can also prove beneficial. This takes advantage of the state's comparative advantages. Yet, the skilled jobs that currently exist in the wood products industry are all in the primary processing sector, e.g., loggers, sawyers and other mill workers. Many of the secondary manufacturers, especially in the furniture industry, do not require highly skilled labor, but rather train unskilled workers on the job. Hence, Washington does not appear to possess a significantly large number of skilled workers in the secondary products sector compared to other states (recall the location quotient data). This does not mean that a skilled, specialty labor force cannot be developed, but it will require additional effort by the state when pursuing this option.

The survey results indicate that many of the factors necessary for secondary manufacturing firms to access the high value, high quality, and high income product niches, like those penetrated by European firms, are not presently available in the state wood products industry. Risk-taking, extensive market knowledge, innovation capabilities, and product and process flexibility are, to varying degrees, lacking in Washington's primary and secondary wood products manufacturers. Yet, by utilizing the leadership of a few of the more aggressive, innovative small firms to spearhead network building, these characteristics can be cultivated within a regional industry. If the benefits are recognized by other firms not involved in the network, they may take the initiative to involve themselves, engendering the process of private sector development and operation of the networks.

FMNs for Sectoral Strategies

The sectorally-directed strategies outlined above, while dependent upon the knowledge and financial leadership of field agents and service centers, can and should eventually be directed by the private sector working through Flexible Manufacturing Networks. Small firms attempting to penetrate foreign markets, develop specialty wood products, or exploit a local resource can operate much more effectively within a network structure. This can be initiated through the public sector's targeted sectoral strategies, and eventually evolve into a private network organization.

A high quality product strategy, as described above, can only be pursued with a sophisticated product development and marketing effort. The cost-cutting commodity product orientation of many of Washington's firms is supported with relatively primitive marketing processes. If there is a move towards these higher quality, higher margin markets, the sophistication of product development, marketing, and in many cases, production technology will have to increase. Field agents will be necessary to help individual firms and subsectors find and grasp the opportunities, while service centers for subsectors will greatly speed the adoption of new marketing and process technologies.

Likewise, selling Washington specialty lumber would require an organization to link horizontally the mill producers of this state in a collaborative marketing effort. Agricultural commodity commissions provide a familiar model for such efforts. The effectiveness of the strategy can be augmented by linking it with the use of more modern technology by the producers. More flexible technology would provide the mills with production capabilities, enabling them to better serve their markets. In this way, the interfirm linkages are created at two points: technology and marketing. Conjoining the knowledge and the technological capability to exploit that knowledge enhances the development strategies.

Vertical linkages between primary and secondary processors, and between wood products firms and the building construction industry (as in pre-built housing), could also be very profitable. This strategy would require the exchange of sectoral marketing and production capability information among firms along the chain of wood products manufacturing. Such shared knowledge would enable mills to cut specifically to a variety of end user needs. The benefits would come from elimination of waste and increased efficiency of the overall manufacturing process.

A specific network strategy involving export marketing cooperatives for mills and secondary processors to help the smaller firms sell their products abroad, would prove highly beneficial. Little cooperation presently ex-

ists in marketing in the secondary wood products industry, but the outreach efforts of field agents, armed with information gained from the research of the centralized service centers, could investigate this possibility.

The problems of both sectors suggest the need for service centers to provide information on possible products, markets, and successful strategies for market and product development. An organization such as CINTRA-FOR plays an important role as a research and technology transfer institute for the industry, but it must be able to disseminate the information to all firms, especially the smaller ones, and to support the information with programs for market penetration. The proposed structure of service centers and field agents would greatly facilitate this process.

The existing informal collaborative efforts indicated in the survey should not be disturbed or formalized. Rather, a network will identify those areas of the industry that are not presently fulfilled by interfirm linkages, such as market information, technology and product development. In this manner, the new network structures will not destroy existing collaboration, but should work to complement it.

A key benefit to the development of sectoral strategies and the privatization of business services, is not so much the specific programs that are developed, but rather the process of building networks, creating linkages and subsectoral self-recognition, developing sources for information and their dissemination, and breaking down barriers to change. The result is the creation of Flexible Manufacturing Networks. While networks can take on many forms and engender various strategies, the network infrastructure that develops in any particular sector will be uniquely formed to provide the greatest benefit to that sector, as it evolves under the direction of the individual firms and industry specialists operating the network.

Summary and Conclusions

As the resource supply issue cannot be ignored, firms in the industry must be made aware of the availability and importance of new technologies, learn to recognize market changes over time and space, be ready to meet the changes, and, most importantly, adjust their products and production methods to maintain economic viability under the conditions of limited resource supply. Unchanging attitudes and unrealistic expectations that supply issues will soon disappear is folly for these firms, especially the smaller ones. An industry reorientation from a resource to a marketing emphasis, which has been suggested in the past by many forest products experts, cannot be overstated or ignored. Firms must learn to adjust and operate within present realities. Networks and other business strategies that work with firms to provide them with the needed information and capability to change are the means by which the small and mid-size wood products firms can be maintained as vital economic entities in Washington.

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Table 1. Washington Wood Products Input-Output Linkages

Total Impact per Million \$ of Direct Final Demand Upon:		
	Earnings	Jobs
Forestry	\$246,000	22.2
Logging	\$633,000	32.6
Sawmills *	\$792,000	42.2
Plywood *	\$716,000	38.5
Other Wood Products *	\$740,000	39.6
Furniture and Fixtures *	\$609,000	38.9
Pulp Mills	\$542,000	25.2
Paper Mills	595,000	28.6
Paperboard, Other Paper	\$648,000	31.8
Wood Products Average	\$613,444	33.3
Wood Products Manufacturing Average *	\$714,250	39.8
Total Washington Industry Average	\$571,000	34.7

Source: Bourque, 1987

Table 2 Employees in Manufacturing, Percentage by Establishment Size, 1971.

<u>Establishment Size (No. Employees)</u>	<u>Emilia- Romagna</u>	<u>Italy</u>
1-5	20.5	17.6
6-9	7.3	5.8
10-19	10.4	8.4
20-49	14.7	12.5
50-99	12.7	10.2
100+	34.4	45.5

Source: Brusco, 1982:170.

Table 3. Employees in all Establishments and Manufacturing Establishments for the United States and Washington, Percentage by Establishment Size, 1986.

Establishment Size (No. Employees)	USA		WA	
	All	Manufacturing	All	Manufacturing
1-4	6.7	1.1	8.2	1.7
5-9	8.9	2.1	10.9	3.0
10-19	11.1	4.2	13.0	5.1
20-49	16.3	9.6	17.8	10.4
50-99	12.8	10.8	13.3	11.0
100+	44.1	72.2	36.8	68.7

Source: County Business Patterns, 1986.

Table 4. Employees in Selected Forest Products Sectors in Washington, Percentage by Establishment Size, 1986.

SIC Code	<u>Forestry</u>	<u>Lumber and Wood Products</u>	<u>Furniture and Fixtures</u>	<u>Paper and Allied Products</u>
	08	24	25	26
Total Employees	2,270	33,284	3,488	15,422
1-4	*	*	4.6	0.2
5-9	8.0	6.2	6.3	0.4
10-19	16.0	9.1	11.1	0.8
20-49	17.1	16.1	35.3	*
50-99	*	16.4	31.7	9.2
100+	*	41.4*	11.0	64.7*

* Data suppressed for confidentiality.

Source: County Business Patterns, 1986.

Table 5. Establishments in Selected Forest Products Sectors in Washington, Percentage by Establishment Size, 1986.

SIC Code	<u>Forestry</u>	<u>Lumber and Wood Products</u>	<u>Furniture and Fixtures</u>	<u>Paper and Allied Products</u>
	08	24	25	26
Total Establishments	157	1,598	205	110
1-4	49.7	45.7	44.4	11.8
5-9	18.5	19.3	15.1	7.3
10-19	16.6	14.2	13.7	9.1
20-49	7.6	10.8	17.1	21.8
50-99	5.1	5.0	8.3	18.2
100+	2.5	5.1	1.5	31.9

Source: County Business Patterns, 1986.

Table 6. Establishments, Employees and Location Quotients (LQ) by SIC.

	SIC 24		SIC 25		All Industries	
	Establishment	Employees	Establishment	Employees	Establishment	Employees
U.S.	31,263	657,853	10,888	492,802	5,806,973	83,380,465
Washington	1,598	33,284	205	3,488	117,922	1,391,415
LQ (U.S.)	2.52	3.03	0.93	0.42		
Grays Harbor	160	3,564	---	---	1,773	16,301
LQ (U.S.)	16.76	27.72				
Lewis	118	2,047	5	88	1,524	13,056
LQ (U.S.)	14.38	19.87	1.75	1.14		
Spokane	49	890	21	247	9,284	114,077
LQ (U.S.)	0.98	0.99	1.21	0.37		

Source: County Business Patterns, 1986.

Table 7. Wood Products Survey Statistics.

	Spokane	Lewis	Grays Harbor	Total
Completed:				
Total	12	13	12	37
SIC 24	9	11	12	32
SIC 25	3	2	0	5
Primary	3	10	7	20
Secondary	8	2	4	14
Wood Treatment	1	1	1	3
Declined to participate	9	6	--	15

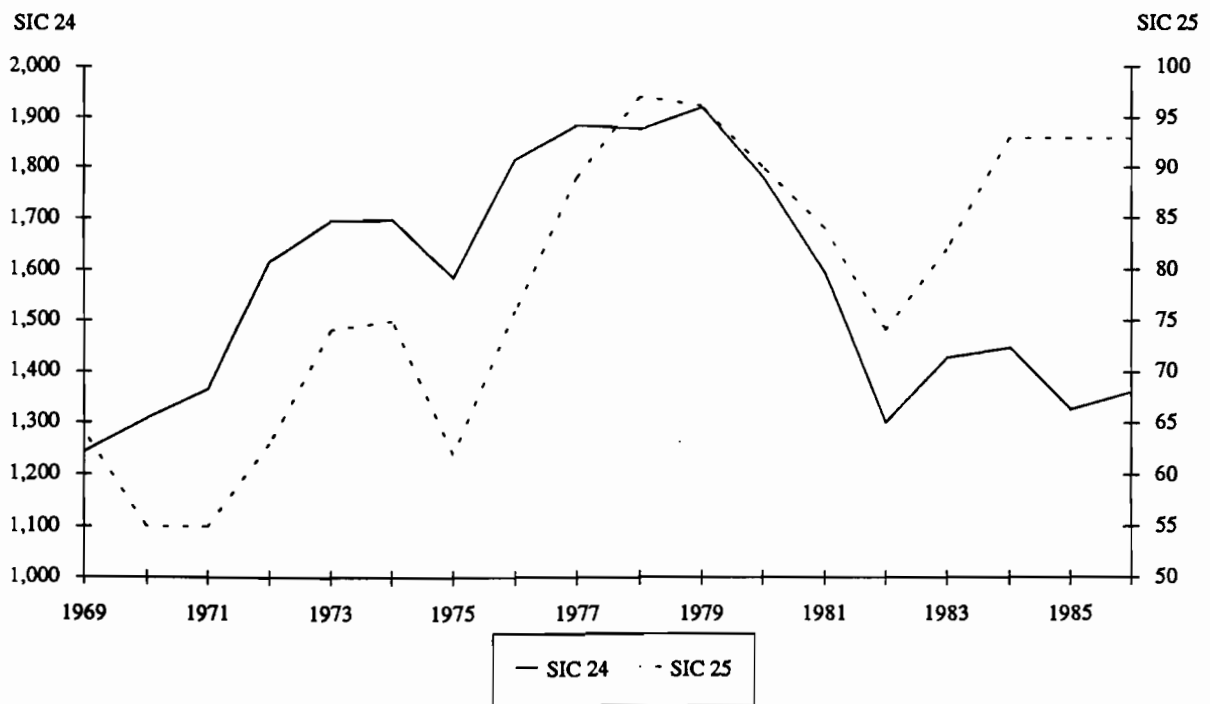
Table 8. Wood Products Subsectoral Breakdown for Survey Analysis.

Primary	Secondary	Wood Treatment
2421	2431	2491
2426	2434	
2429	2439	
2435	2441	
2436	2448	
2499	2451	
	2452	
	25...	

Note: Refer to Table 9 for SIC Code Classification.

Table 9. Washington Wood Products Manufacturing Subsectors, by U.S. Standard Industrial Classification (SIC).

24	Lumber and Wood Products		
	241	Logging camps and logging contractors	
	242	Sawmills and planing mills	
	2421	sawmills and planing mills, general	
	2426	hardwood dimension and flooring	
	2429	special product sawmills, n.e.c.	
	243	Millwork, plywood and structural members	
	2431	millwork	
	2434	wood kitchen cabinets	
	2435	hardwood veneer and plywood	
	2436	softwood veneer and plywood	
	2439	structural wood members, n.e.c.	
	244	Wood containers	
	2441	nailed wood boxes and shook	
	2448	wood pallets and skids	
	245	Wood buildings and mobile homes	
	2451	mobile homes	
	2452	prefabricated wood buildings	
	249	Miscellaneous wood products	
	2491	wood preserving	
	2499	wood products, n.e.c.	
25	Furniture and Fixtures		
	251	Household furniture	
	2511	wood household furniture	
	2512	upholstered household furniture	
	2515	mattresses and bedsprings	
	252	Office furniture	
	2521	wood office furniture	
	2522	metal office furniture	
	253	Public building and related furniture	
	254	Partitions and fixtures	
	2541	wood partitions and fixtures	
	259	Miscellaneous furniture and fixtures	
	2591	drapery hardware and blinds and shades	
	2599	furniture and fixtures, n.e.c.	



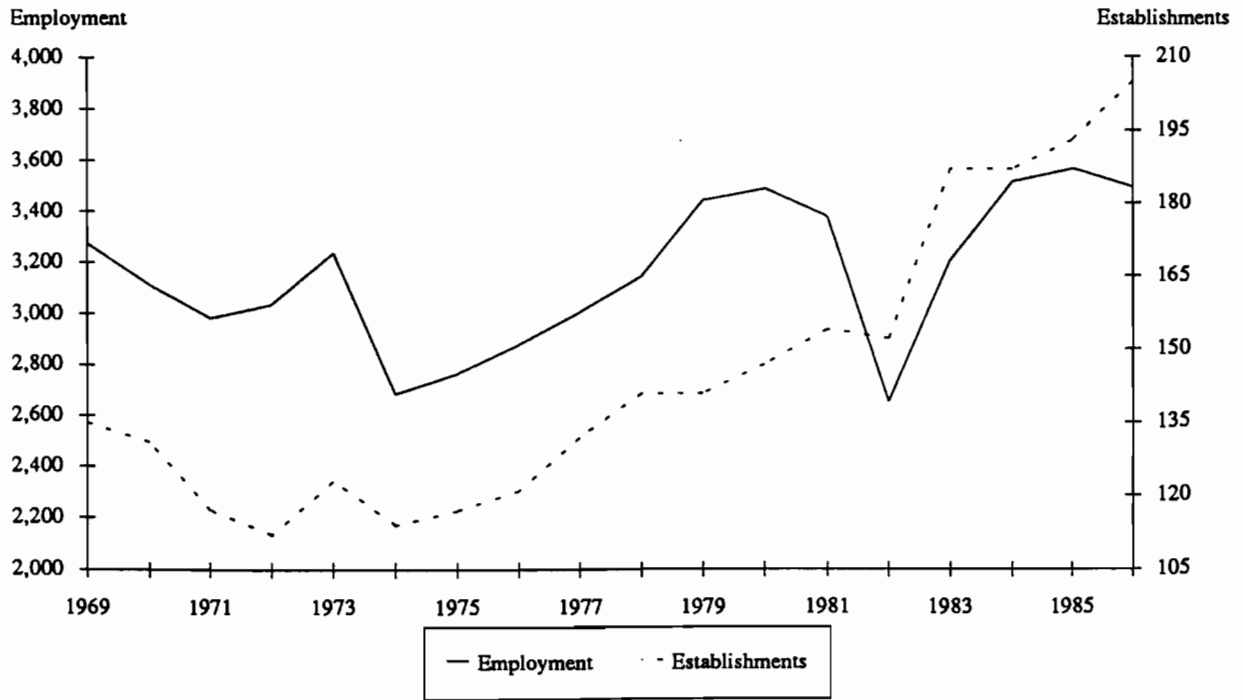
Source: U.S. Department of Commerce, Bureau of Economic Analysis, "Gross State Product by Industry, 1969 - 1986," 1988.

Figure 1. Gross State Product (Millions of Dollars), Lumber and Wood Products (SIC 24) and Furniture and Fixtures (SIC 25).



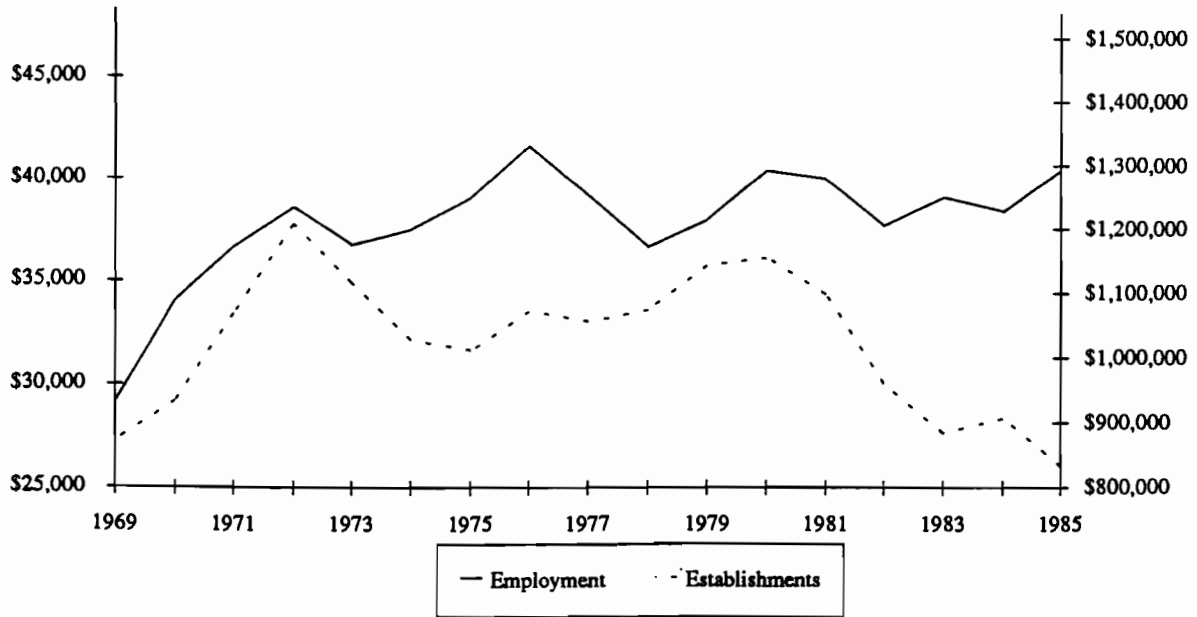
Source: U.S. Department of Commerce, Bureau of the Census, County Business Patterns, (for the years 1969-1985).

Figure 2. Employment and Establishments, Lumber and Wood Products (SIC 24).



Source: U.S. Department of Commerce, Bureau of the Census, County Business Patterns, (for the years 1969-1986).

Figure 3. Employment and Establishments, Furniture and Fixtures (SIC 25).



Source: U.S. Department of Commerce, Bureau of Economic Analysis, "Gross State Product by Industry, 1963-1986," 1988; and U.S. Department of Commerce, Bureau of the Census, County Business Patterns (for the years 1969-1985).

Figure 4. Gross State Product per Employee and Establishment, Lumber and Wood Products (SIC 24).

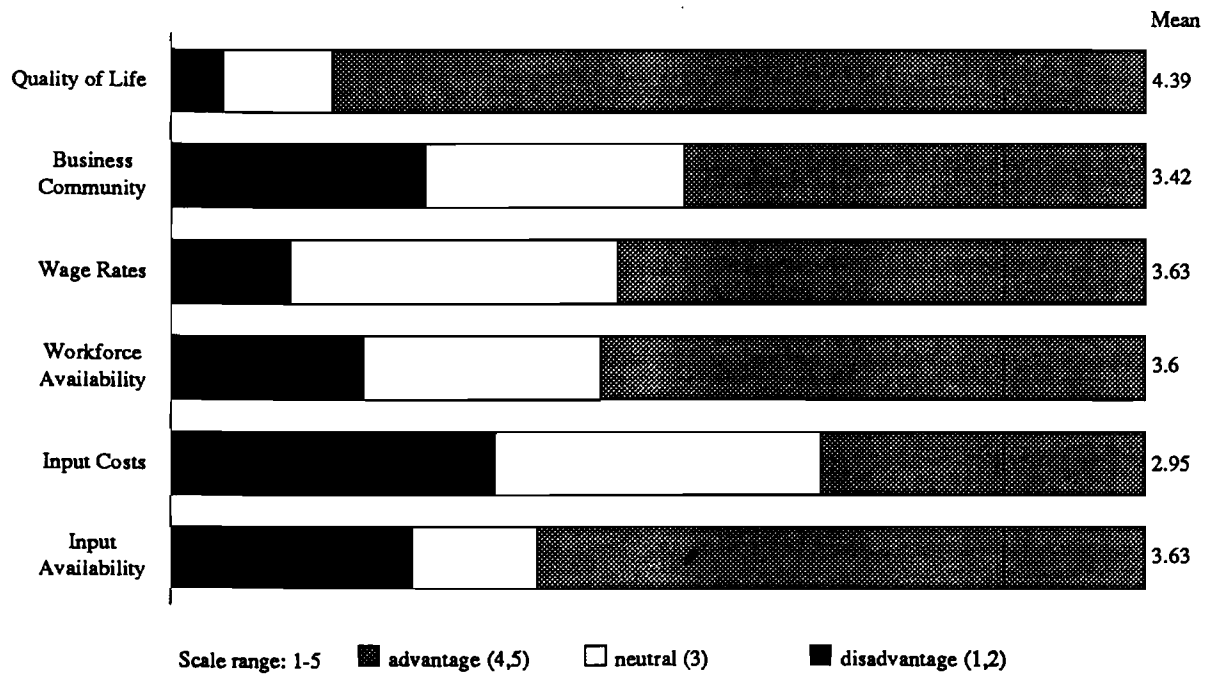


Figure 6. Advantages of Present Business Location (Distribution of Responses, Wood Products Industry).

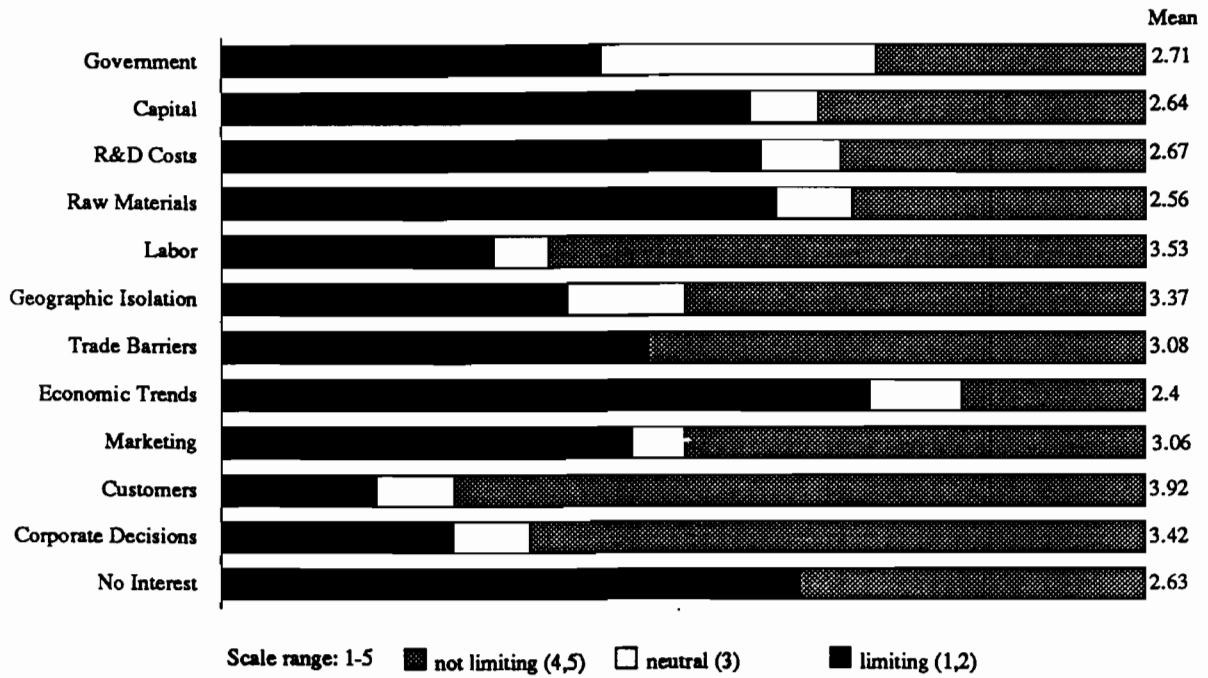


Figure 7. Factors Limiting Development of New Markets and Products (Distribution of Responses, Wood Products Industry).

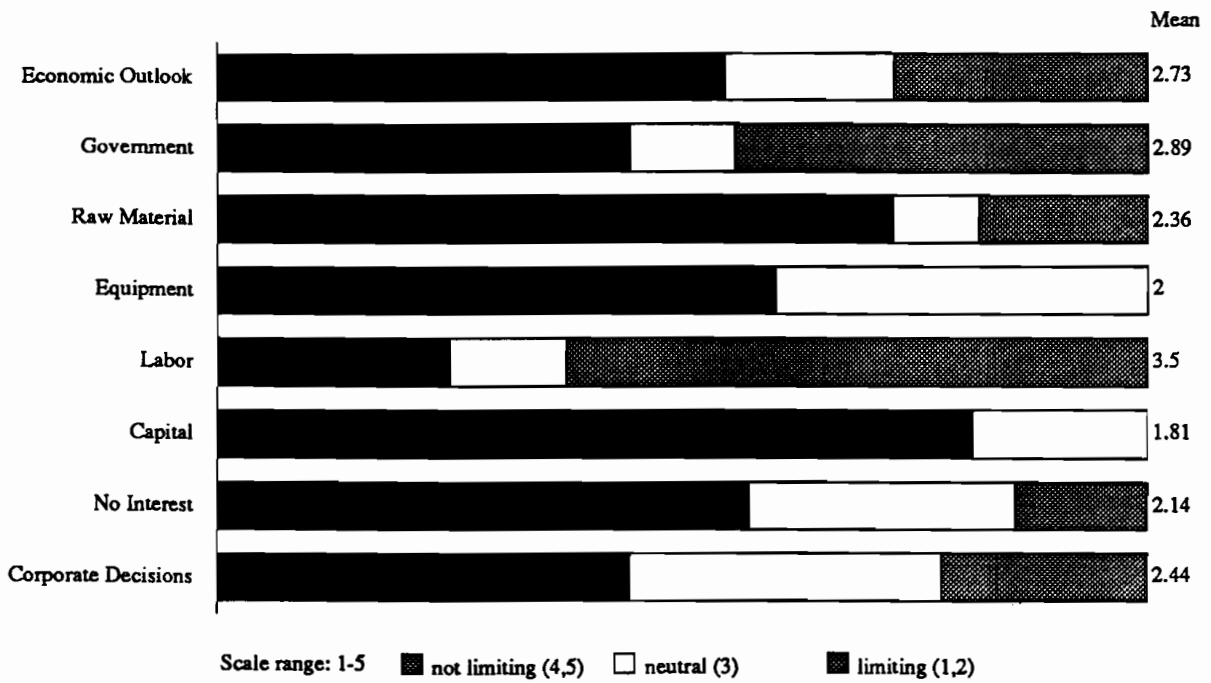
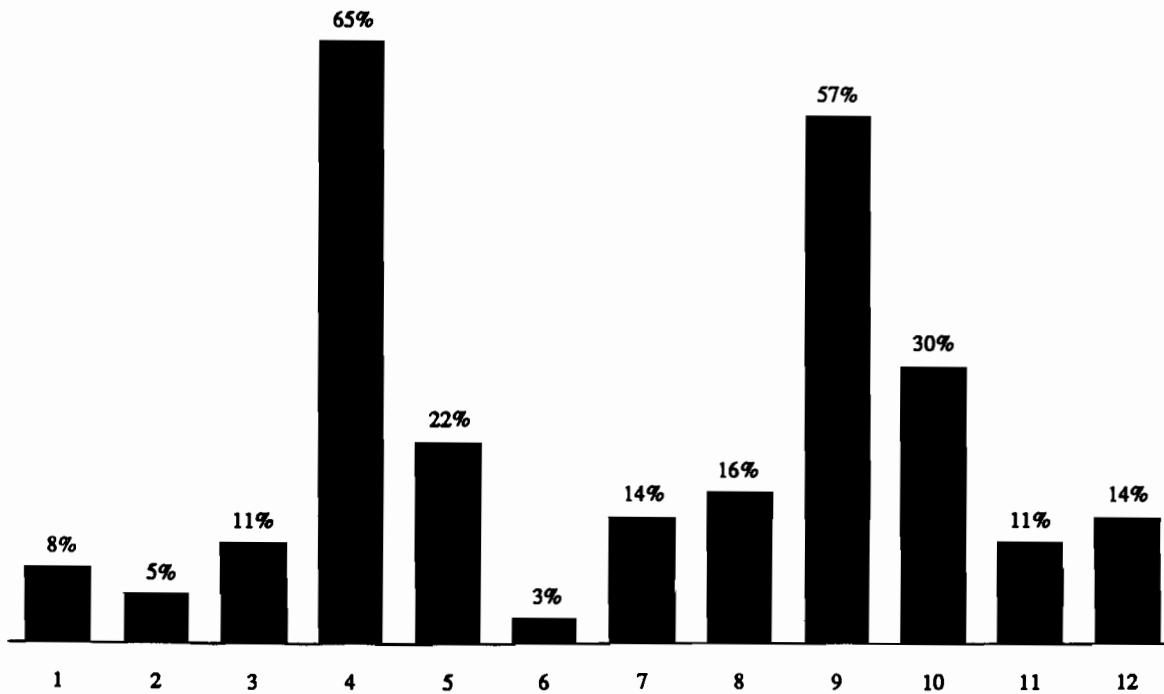


Figure 8. Factors Limiting Investment in New Equipment and Facilities (Distribution of Responses, Wood Products Industry).



- Problems:
- | | |
|-----------------------------|---------------------------------------|
| 1. Labor Supply or Cost | 7. Market Trends |
| 2. Labor Relations | 8. Taxes |
| 3. Quality Control | 9. Government Regulations or Policies |
| 4. Raw Material Avail./Cost | 10. Competition |
| 5. Capital Avail./Cost | 11. Marketing Capability |
| 6. Outdated Facilities | 12. Other |

Figure 9. Important Problems Facing Firms in Wood Products Industry (Distribution of Responses with Percent of all Firms Identifying Problem as First, Second, or Third Level of Importance).

Appendix A

**NORTHWEST POLICY CENTER QUESTIONNAIRE
for
WASHINGTON STATE FIRM INTERVIEWS**

Hello, I am your name from the Northwest Policy Center at the University of Washington. We are conducting a study for the Washington Business Assistance Center on competitiveness and modernization issues facing the name of industry. I would like to ask you some questions about your company. The results will be kept absolutely confidential, and no individual firm will be identifiable in our report to the state. The interview will take about 30 minutes. Is this a good time to do it? If not, when would be a good time to call back? [If you do not want to take the time to complete the whole survey, could you just tell me how many people you employ and what your principal products are?]

Company Information

Firm Name: _____

Address: (street) _____

(city) _____ (zip) _____

(county) _____

Telephone (____) _____

1. The company is a: (check box)
 corporation
 partnership
 sole proprietorship
 subsidiary of another company

parent company name: _____

address: _____

2. What is your name and title?

(name)

(title)

3. Year company established: _____

4. General Type of Business (please describe):
5. Principal Products Manufactured (please list):

Employee Information:

7. Are these employees represented by a union?
IF YES, get name of union: _____
8. What type of training is needed by your employees to perform their jobs in your plant?
____ On the job training
____ Apprenticeship training
____ High school graduation
____ Community college courses
____ 4-year college or university degree
____ Other (please specify): _____
9. Have your training needs changed in the past 5 years?
____ NO ____ YES
IF YES, how have they changed?

Plant Information:

10. Please describe briefly the equipment and processes used in your facility.
11. Is your plant and equipment (check one):
____ fully utilized
____ near capacity
____ somewhat underutilized
____ greatly underutilized

12. What is your current production level as a percent of the level:

PERCENT PERCENT
_____ 1 year ago _____ 5 years ago

13. Has the plant undergone any significant modernization, renovation, or re-equipping in the last 10 years?

_____ NO _____ YES

IF YES, when?

What was done?

Market Information

14. What percent of your products are sold in the following areas:

PERCENT

- ___ Local area
- ___ Washington
- ___ Pacific Northwest
- ___ California
- ___ Western States
- ___ Other U.S.
- ___ British Columbia
- ___ Other Canada
- ___ Asia
- ___ Europe
- ___ Other foreign: _____

15. Has the percentage sold to these areas (in last question) changed much in the last 5 years? In what ways? (Interviewer: notes in white space above)

16. To whom do you sell your products? (read list and ask respondent to estimate the percent of total sales that go to each type of customer)

PERCENT

- Other manufacturers or building contractors
- Independent manufacturer's representatives or wholesalers
- Direct to retail outlets
- Direct to consumers
- Institutional/public sector
- Other (please describe) : _____

17. How do you promote your products?

CHECK ALL THAT APPLY

- word of mouth promotion
- direct mail
- telephone sales
- media advertising
- sales representatives
- industry associations
- trade shows or trade journals
- distributors or brokers
- other (please describe): _____

18. What are the advantages and disadvantages of your present business location?
 (Please rank the following factors from 1--very disadvantageous, 2--somewhat disadvantageous, 3--neutral, 4--somewhat advantageous 5--very advantageous.)

1	2	3	4	5	Availability of inputs
1	2	3	4	5	Cost of inputs
1	2	3	4	5	Availability of workforce
1	2	3	4	5	Prevailing wage rates
1	2	3	4	5	Local business community
1	2	3	4	5	Quality of life in local area
1	2	3	4	5	Other (please describe): _____

19. In the last 5 years, have you added or dropped any products from your line? IF YES, what were they and what problems or opportunities led to this decision?

ITEMS ADDED

REASONS

ITEMS DROPPED

REASONS

Business Relationships

20. Have you ever undertaken a joint venture with another firm, or subcontracted for major components of your product? If yes, what types of firms and products were involved?

21. Does your company work with any other companies in responding to hazardous waste management problems, or in decreasing the generation of hazardous wastes?

(IF YES, ask respondent to describe the nature of the collaboration)

22. I would like to get a sense of where you obtain inputs to your production process. Could you give a rough estimate of what percent of your materials and parts, outside services, and machinery or equipment come from the local area or other regions. Starting with materials and parts, what percent of these items come from:

[repeat for outside services, and for machinery & equipment]

	<u>Materials & Parts</u>	<u>Outside Services</u>	<u>Machinery & Equipment</u>
Local area	_____	_____	_____
Washington	_____	_____	_____
Other Pacific Northwest	_____	_____	_____
California	_____	_____	_____
Other western states	_____	_____	_____
Other U.S.	_____	_____	_____
British Columbia	_____	_____	_____
Other Canada	_____	_____	_____
Asia	_____	_____	_____
Europe	_____	_____	_____
Other foreign countries (please specify country and item)	_____	_____	_____

26. What factors most limit your firm from investing in new equipment or facilities?

(Please rank by circling the appropriate number: 1--very limiting to 5--not limiting at all)

Very Limiting		Somewhat Limiting		Not Limiting	
1	2	3	4	5	Bound by decisions at corporate level
1	2	3	4	5	No interest in or need for new equipment or facilities
1	2	3	4	5	Availability or cost of capital
1	2	3	4	5	Availability or cost of labor, or training costs
1	2	3	4	5	Availability or cost of equipment
1	2	3	4	5	Availability or cost of raw materials
1	2	3	4	5	Government regulations or taxes
1	2	3	4	5	Economic outlook uncertain
1	2	3	4	5	Other (please describe): _____

27. What are the three most important problems facing your firm today?

(Please nominate three and rank: 1--most important, 2--second most important, 3--third most important)

- _____ Labor supply or cost
- _____ Labor relations
- _____ Quality control
- _____ Raw material availability or cost
- _____ Availability or cost of capital
- _____ Outdated production facility
- _____ Market trends
- _____ Taxes
- _____ Government regulations or policies
- _____ Competition
- _____ Marketing capability
- _____ Other (please list) : _____

29. (IF APPROPRIATE) Would you like to participate in a group discussion of opportunities to reshape the state's business assistance programs to serve your industry better?

_____NO _____YES

30. Would you like to receive a copy of the results of this study?

_____NO _____YES