FLEXIBLE SPECIALIZATION AND THE CASE OF THE REMANUFACTURING INDUSTRY IN THE LOWER MAINLAND OF BRITISH COLUMBIA

by

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Flexible Specialization And The Case Of The Remanufacturing Industry In The Lower Mainland Of British Columbia

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Abstract

The recession of the early 1980's marked a watershed for the forest product industry of British Columbia. Forest product manufacturers undertook restructuring in an attempt to reduce the vulnerability associated with product and market specialization. This restructuring is apparent in primary manufacturing with the increased emphasis upon market diversity and value-added products, and in the promotion of a secondary manufacturing sector, primarily that of remanufacturing. It has been argued that the restructuring of the past decade within the global economy, including with respect to the British Columbia forest industry, is an attempt to achieve 'flexibility' in regards technological, industrial and labour organization, and is encapsulated in the concept of 'flexible specialization'. Furthermore, some commentators suggest the emergence of a flexibly specialized production system results in the re-agglomeration of economic activity and the increased importance of the 'industrial district'. This thesis examines the sense in which the remanufacturing industry of the Lower Mainland exhibits flexible specialization. The research was carried out through an in-depth, case study analysis of seven remanufacturing firms located within the Lower Mainland, providing a variety of experience and insight, and backed up by aggregate data drawn from industry reports. Results indicate that the remanufacturing industry of the Lower Mainland operates through a flexibly specialized production system, with a significant degree of vertical disintegration apparent. Production utilizes a social division of labour through a network of contractor - subcontractor linkages, with contracting out used to minimize the risk of operating in an uncertain environment. The majority of firms attain in-house flexibility through the use of unsophisticated, multi-purpose machinery and flexible forms of labour organization. Results indicate that the nature of technological and labour flexibility is influenced by the position of the individual firm within the production system. Lastly, evidence suggests that the Lower Mainland represents a remanufacturing industrial district.

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I guess this is the part of the thesis where I can write whatever I want, without getting questioned on it by my supervisor. So now, for the first time in my life, I am lost for words! There are so many people to thank and for a variety of different reasons. So at the risk of this sounding like some pretentious awards ceremony, here goes...

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Chapter 1

The Forest Industry of British Columbia: From Fordism to Flexibility

Restructuring in the British Columbia Forestry Industry

The recession of the early 1980's marked a watershed for the forest product industry of British Columbia (Barnes and Hayter, 1993). At this time, forestry firms underwent economic turmoil. A provincial profit of $500 million in 1979 turned into a $500 million loss just two years later (Barnes *et al*, 1990) and these financial losses were soon translated into job losses, as at least 23,000 workers were laid off in the three year period 1979 to 1982. Many of these job losses were concentrated along the coast where older mills using traditional technology were no longer able to survive in an increasingly turbulent and competitive market. The recession resulted in permanent job loss in an industry accustomed to secure employment, a security built up over many decades of union-management collective bargaining, stable product markets, an oligopolistic industrial structure and mass production, characteristics that have been termed 'Fordist'. The recession not only resulted in a loss of production and trades' jobs but, for the first time, managerial positions were affected. Moreover, since the 1980's job loss has been associated with changes in work organization. In this regard, Hayter and Barnes (1992 and 1993) have argued that in the British Columbia economy as a whole, and the forest product sector in particular, there are shifts towards more flexible forms of production and employment.

British Columbia's Staples Economy

Throughout its economic history, the economy of British Columbia has largely specialized in the production of a narrow range of commodity products, namely fish, fur, gold, copper, zinc, coal and forest products for export markets. As Hayter and Barnes note "the export of a succession of staples, principally to the United States, has been the main engine

of growth of British Columbia since its incorporation within the world economy" (Hayter and Barnes, 1990, p. 161). For example, in 1986 over 90% of B. C.'s visible exports were either raw materials or primary manufactured products, with 48% of commodity exports leaving British Columbia headed for the United States (Hayter and Barnes, 1990). Within the staples sector, which includes resources and primary manufacturing activities, the forest product industries have long been the most important component. In fact, in the early 1970's it was estimated that 50 cents out of every dollar spent in British Columbia was generated by the provincial forest industry (Farley, 1972). In the late 1980's British Columbia accounted for 61% of Canada's lumber production and 72% of Canada's lumber exports (Hayter, 1992). The impacts of the recessionary crisis of the 1980's and 1990's upon the forest product industry of British Columbia were therefore widely felt throughout the provincial economy as a whole.

Despite the marked changes in forestry employment during the early 1980's, the economic strategy of British Columbia continued to focus upon the export of raw or primary manufactured resources, with over 90% of provincial exports between 1981-86 comprising of crude materials and low value forest products, due, at least in part, to the inertia imposed by fixed capital and a resource hinterland political philosophy. As Hayter and Barnes note "despite a recession that pointedly indicated the need for diversification, British Columbia remains a staples economy" (Hayter and Barnes, 1990, p. 163), specializing in the manufacture of a narrow range of 'low-value' commodities for largely North American consumption.

In this respect, the economy of British Columbia shares characteristics with much of the Canadian resource hinterland. As Innis (1930) argued, the Canadian economy developed through the exploitation of 'staples' or resources and primary manufactured products, namely fish, fur, lumber, pulp, and paper products. Following from Innis, Watkins (1963) argued that due to the comparative advantage held by staples for exporting, the potential for economic development related to a diversification process around the

staples industries generated via backward, forward and final demand linkages. However, Watkins noted that this diversification process is not automatic and may be impeded in at least two ways. First, the creation of an export mentality reduces the range of economic activities in which capitalists are willing to invest, which reduces the chances of industry or even inter-industry diversification. Second, the need for large amounts of fixed-capital investment to establish plants dedicated to mass production favours large, oligopolistic and externally controlled firms who transfer demands for high-end functions such as research and development to 'metropolitan' economies where parent companies are based. Consequently, in the resource region, a 'truncated' branch plant economy develops in which economic multipliers are limited. In these ways, staple development can become a staple trap.

In British Columbia, the extent of diversification around the staples economic strategy, based upon the export of fish, minerals and especially forest products, has been limited. Whatever the causes, British Columbia's forest product sector entered the 1980's as it originally evolved - as a large volume supplier of bulk commodities, and proved highly vulnerable to the changes and economic pressures of the 1980's. At this time, the impacts of the recession upon the forest product sector were intermingled with long run changes in supply, demand and technological conditions (Barnes *et al*, 1990; Hayter and Barnes, 1992; Marchak, 1983). In reaction to these pressures the forest product industry has undertaken significant restructuring in the last decade. Many outdated mills have been closed, other mills have undergone in-situ investment and restructuring in an attempt to become more cost competitive and produce products of higher value to serve global markets, while a variety of small scale activities comprising the 'value added' sector have become more important (Grass and Hayter, 1989; Hayter and Barnes, 1992; Price Waterhouse, 1992).

In practice, the kinds of changes occurring in the forest product industry of British Columbia were part of deep seated economic changes affecting traditional, mass production

industries throughout many western capitalist economies. Some observers have called this a crisis in 'Fordist' production.

The Crisis of Fordist Production

Throughout the so-called 'thirty golden years' of the post-war period, many industries enjoyed high profit margins and growth rates through the utilization of mass production technologies and labour-management agreements which, among other elements, indexed wages to productivity. This 'technological-institutional system' has been labelled 'Fordism' which is defined as "an insistent search for internal economies of scale via increasing standardization of outputs, routinization of processes, and rigidly dedicated capital equipment" (Storper and Scott, 1989, p. 23; see also Aglietta, 1979). Profit from Fordist production was derived from increasing productivity per worker and decreasing cost per unit output, thereby utilizing economies of scale, with competition largely based upon price rather than quality. Such growth was particularly evident in the national economies of the OECD, such as the United States, Canada, Britain and West Germany. However, in the early 1970's, and particularly in the early 1980's, these Fordist mass production industries that had served as the propulsive engines of economic growth experienced a series of internal and external pressures which reversed the trend from growth to decline, breaking down the technological-institutional system upon which Fordism was predicated. From a North American standpoint, the internal pressures most notably included falls in productivity (Holmes, 1988), the saturation and fragmentation of market demand (Piore and Sabel, 1984), production capital reaching the limits to economies of scale (Freeman, 1987), increased worker militancy (Storper and Scott, 1989) and inflationary pressures. External pressures affecting Canadian and U. S. industries included the oil crisis of 1973 and increased international competition from Japan and the Newly Industrializing Countries (NIC's).

During the 1970's, the decline in productivity, economic growth and industrial employment which, when combined with increased international competition, resulted in economic crisis and the subsequent restructuring of the 1980's. As O'Connor notes "[crises] compel capital to reorganize itself to prepare for new rounds of capital accumulation...Capital accumulates through crises which become the cauldrons in which capital qualitatively reorganizes itself for future economic expansion" (O'Connor, 1982, p. 312). The nature of these changes are problematic. If crises truly result in a new strategy of capitalist accumulation, necessitating the restructuring of now inappropriate and inefficient industries, then questions arise as to how this restructuring creates a competitive advantage so as to warrant such deep seated economic changes.

Piore and Sabel (1984) have suggested that the restructuring witnessed over the past 10-20 years represents a turning point or 'second industrial divide' in the method of capitalist accumulation (see also Scott and Storper, 1992). This restructuring has often been labelled as a movement from Fordist to Post-Fordist production or as a strategy of 'Flexible Accumulation' (Harvey and Scott, 1988). Although there is considerable controversy regarding the extent and characteristics of this transition, in one way or another most observers have emphasized the increasing importance of 'flexibility' in production and organization. Such restructuring towards a more flexible strategy has affected both high and low technology manufacturing industries (Piore and Sabel, 1984; Scott and Kwok, 1989), large as well as small firms (Sabel, 1989), the service and finance sectors (Storper and Christopherson, 1987; Tomlinson, 1989), as well as the manufacturing sector in general.

Several observers have also suggested that this restructuring has implications for the spatial distribution of industrial activity. Thus, Scott (1988) has suggested that an important theme of recent restructuring has been the emergence of 'new industrial spaces' (Scott, 1988b) in such regions as Southern California (Scott, 1984; Scott and Kwok, 1989), the 'Third Italy' (Piore and Sabel, 1984), and the Paris Basin (Lorenz, 1992;

Lipietz, 1985). Furthermore, Storper and Scott suggest that this restructuring has "been posited on the development of alternative ways of organizing production systems" (Storper and Scott, 1989, p. 21), through the use of a social division of labour (contracting - subcontracting relationships), just-in-time delivery systems, and increased technological and labour flexibility. The rate of industrial restructuring varies spatially due to variations in the level of inertia imposed through entrenched technological requirements and techniques, institutional constraints such as unionization, risk minimization, and socio-cultural attitudes (Gertler, 1988; Hoffman and Kaplinsky, 1988; Schoenberger, 1987). Nevertheless, according to Piore and Sabel (1984) the present period of restructuring is one in which a central issue is the emergence, or re-emergence, of flexible production systems.

Technology and Flexible Specialization

There is no single, fully endorsed definition of flexibility. As Gertler (1992) points out, "there are many forms and many sides to this rather slippery concept of flexibility" (p. 273). However, as with Fordist technology, the impacts and implications of new technologies are widely recognized as central to the development of flexible production systems. As Gertler (1988) notes, "at the heart of this supposed revolution in production methods is a new generation of qualitatively distinct fixed capital...[with the]...ability to be redeployed in an endless number of ways" (p. 420). Whereas Fordism used task-dedicated machinery to produce standardized products to take advantages of economies of scale, flexible technology takes advantage of economies of scope, emphasizing product quality and heterogeneity, and the use of computer controlled machinery to produce new or old products in new ways through batch production. The use of reprogrammable machinery and artificial intelligence in the form of robots therefore extends the utility and life of fixed capital, since changes in consumer demand does not necessitate the scrapping of 'old' machinery in order to manufacture to new specifications. As such, technological flexibility

offers the advantage of being able to react to changes in demand more easily, without the expense (and inertia) of having to scrap fixed capital (Schoenberger, 1987).

The implications of flexible technology that are evident in increased product diversity (often in order to serve a variety of niche markets) and an increase in product quality (moving up the 'value-added ladder') are further intertwined more broadly with changes in industrial organization and with management - labour relationships. Thus, Piore and Sabel (1984) consider 'flexibility' to be a key theme in understanding changes in industrial organization and regional development. Using evidence taken from 'the Third Italy', Piore and Sabel proposed that the emergence of a flexible production system implies that tasks become externalized. Tasks previously carried out 'in-house' by vertically integrated firms are contracted out to subcontractors, resulting in the vertical disintegration of production at the individual firm level. A 'social division of labour' emerges whereby firms rely upon a network of subcontractors and suppliers to perform certain production processes, and where inter-firm communications become an important feature of the productive process. Furthermore, to ensure the efficient operation of this social division of labour, flexible production is typically associated with the use of the Just-In-Time (JIT) delivery system, which features numerous, small scale interactions in order to reduce inventory costs and enhance quality. Piore and Sabel propose that such a production system allows firms to react more quickly to market demands and changes in taste by utilizing the variety that exists throughout the local production system, thereby overcoming the uncertainties associated with market fragmentation.

The second conceptualization of flexibility pertains to developments in labour relations. As mentioned earlier, Fordist labour - management relations were characterized by strict job demarcation, job security through seniority, and the indexing of wages to productivity. Furthermore, in the 1960's and 1970's the limited level of skill required for assembly line tasks allowed management to separate production over space, resulting in a spatial division of labour with the utilization of cheap labour in peripheral areas. By

contrast, Atkinson (1984) argued that labour requirements emphasized increased flexibility during the 1980's and that the rigidities of Fordist labour-management relations were no longer appropriate for contemporary competitive conditions. Replacing the traditional Fordist segmentation of workers is a more flexible one based on the distinction between core (functionally flexible) and peripheral (numerically and financially flexible) workers. According to Atkinson, 'functionally flexible' workers are characterized as highly skilled, problem solving staff with the ability to do a variety of different jobs. 'Numerically flexible' workers are those hired to deal with fluctuations in demand, such as part time and temporary workers, with 'financially flexible' workers used by a firm to minimize costs through contracting out and positioning lower paid workers in jobs traditionally paying higher wages.

Geographers have been quick to point out the possible spatial implications of flexible production (Storper and Scott, 1989; Scott and Storper, 1992; Gertler, 1988). In particular, Storper and Scott have argued that the dominance of flexible production systems *a la* Piore and Sabel will increase the importance of inter-firm relationships and promote industrial agglomeration due to the emergence of a social rather than a spatial division of labour. Furthermore, it has been argued that the nature of industrial agglomeration is rooted in the characteristics of place, such as local industrial structure, socio-cultural attitudes and ideology, and the quality of local labour markets. Indeed, it is suggested that the emergence of flexible production systems have provided the basis for the re-emergence of 'Industrial Districts' in places different from regions of traditional Fordist production and to areas relatively free of the latter's economic and social attitudes. Examples of these new industrial districts include the sunbelt area of the United States, the Cambridge area of England, and the Emilia-Romagne region of Italy (Storper and Scott, 1989). For Piore and Sabel, Scott and Storper the re-emergence of the industrial district represents the spatial manifestation of flexible specialization.

Evidence has therefore emerged to support the argument that the restructuring of the early 1980's represents a turning point in the method of capitalist accumulation in many of the major world economies. This restructuring has implications for production within and between firms, for the trade-off between labour and technology, and for the spatial patterns of industrial activity. It is now necessary to take a closer look at the implications of this move to flexible production for the forest product industry, and more specifically the remanufacturing sector, of British Columbia.

Value-added and the Remanufacturing Industry of British Columbia

The forest product industry of British Columbia suffered significantly during the recession of the 1980's and experienced a series of distinct changes in terms of employment and geography. This recession, and associated restructuring, resulted in calls for a change in the industrial strategy pursued politically by the provincial government and by the business community of British Columbia. In particular, it is argued that "British Columbia's natural resource development under traditional forms of management has reached its upper limits...[there is]...the need for an upward shift in product-mix and a shift in management attitudes away from [a purely] production focus to aggressive marketing, aimed at the pursuit of value, not volume - doing more, with less" (Woodbridge and Associates, 1992, p. 1,13). This quote reflects the key aim of forest product policy in British Columbia in the early 1990's and the realization that mass production of standardized, commodity products of relatively low value does not reflect the true value of the province's resource base. That is, "some dramatic changes in the lumber product-mix segment and employed technology will be necessary in the 1990's" (Meil, 1990). In particular, Woodbridge (1992), Meil (1990) and others suggest a strategy of high volume, low value production needs to be replaced by a strategy of adding-value to the resource base through an emphasis upon quality and product diversity (see Figure 1.1). What is meant by value-added?

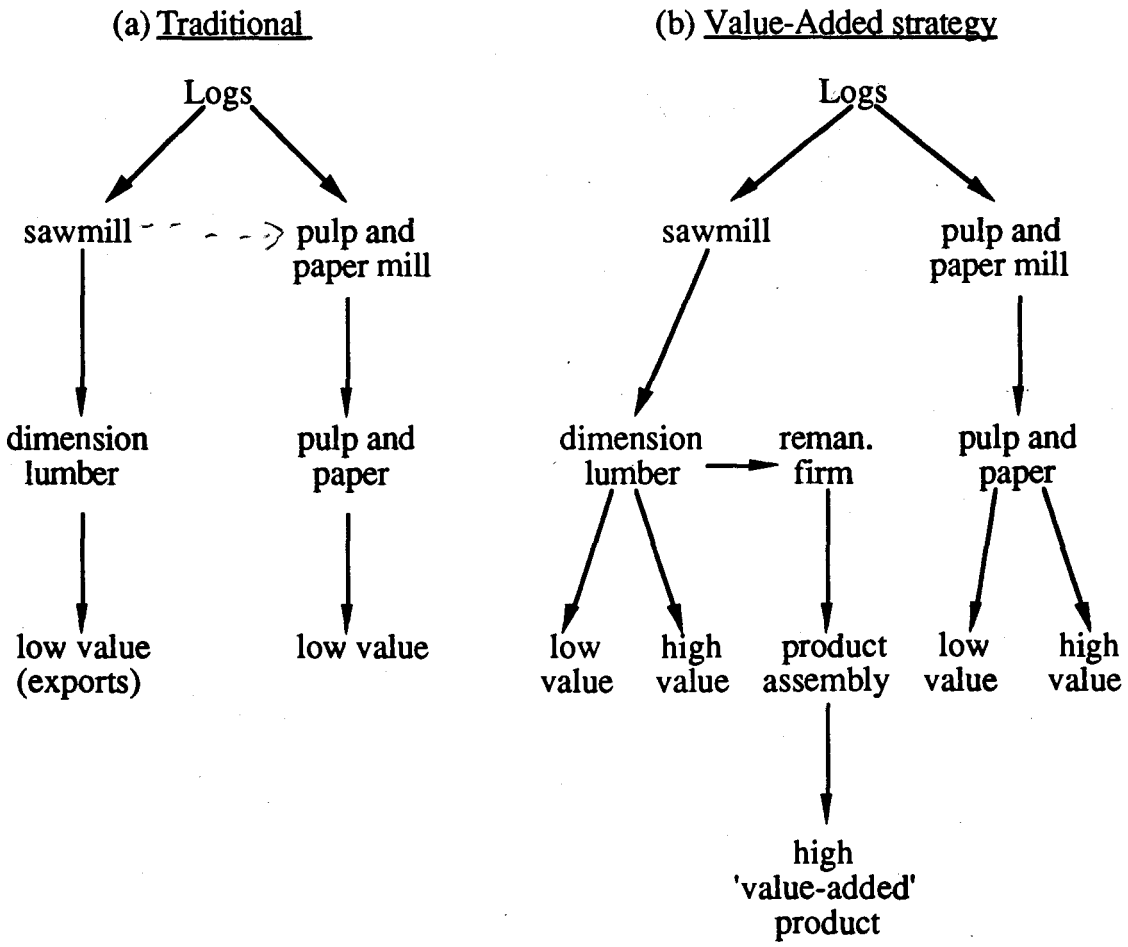
Value-added refers to processes within a factory that are applied to a set of inputs when producing a product. Statistics Canada measures value-added as the value of production output less the costs of materials, supplies and energy (Statistics Canada, Canadian Forestry Statistics, cat 25-202). For the less energy intensive industries, such as the softwood lumber industry, value-added can primarily be viewed as the difference between raw material costs at the factory gate and the value of the resulting product to the customer. In the case of British Columbia, value has been added to the forest resource through primary manufacturing, specifically in the production of dimension lumber, the breaking down of wood fibres into kraft pulp, and the manufacture of newsprint. Each of these industries, which in the past have served as the staples of the provincial economy, add value to the forest resource since the consumer is willing to pay more for the processed product than the raw, unprocessed resource.

The recession of the early 1980's highlighted the need to shift to a strategy of adding greater value to the resource base through an increased emphasis upon secondary manufacturing (Figure 1.1). Furthermore, with increased demand from Asia, especially Japan, such restructuring was recognized as holding realistic and potentially profitable opportunities. Consequently, since the mid-1980's, government and industry leaders have focused their attention towards a value-added wood products strategy in an attempt to increase global competitiveness and diminish the product and market specialization of the industry. An important focus of such a strategy has been secondary manufacturing, specifically the remanufacturing industry.

The focus of the emerging strategy for forest products in British Columbia is a belated attempt to climb further up the value-added ladder beyond bulk commodities. This strategy wields a double edged sword. The first of these focuses upon the traditionally high volume - low value sawmill and pulp and paper industries (primary manufacturing sector), encouraging a shift in production emphasis towards a broader and higher value product mix, such as engineered wood for construction or specialty papers. The

characteristics of restructuring in this primary manufacturing sector have been well documented by research carried out over the last five years (Barnes *et al*, 1990; Hayter and Barnes, 1992). Second, it promotes the development of a value-added wood product industry (secondary manufacturing sector) in British Columbia based upon small 'flexible' firms producing high value specialty products for niche markets (see Figure 1.1). Indeed, over the last decade, and especially since 1986, the remanufacturing industry of British Columbia has received much government attention and, through the Small Business Forest Enterprise Programme, direct government support.

Figure 1.1 - The changing strategy of the forest product industry in British Columbia



The remanufacturing industry is the largest sector of the value-added industry in British Columbia and can best be defined as the sector of the forest product industry involved in adding value through the production of lumber specialty products. Remanufactured products are of relatively high value, most often produced from commodity lumber of lesser value from local sawmills. As shown in Figure 1.1b, acting as the link between lumber produced in sawmills and final product integration, the remanufacturing industry can be seen as a major player in adding value to the forest product exports of British Columbia. Remanufacturing firms are involved in the secondary manufacture of lumber into a diverse range of products, such as window and door components, indoor stair components and panelling, exterior sidings, furniture components and many other products. It should be stressed that remanufacturers in general do not produce the final product but produce components of specific dimensions, grade and size to match exactly the demands of the final assembler. The characteristics and significance of the remanufacturing sector within the forest product industry is studied in greater detail in chapter 3. However, it may be noted that the remanufacturing industry in British Columbia currently employs approximately 3500 people in 150 firms. These firms are small, employing an average of 23 people, with 72% of all remanufacturing firms located in the Lower Mainland (Price Waterhouse, 1992). As such, these specialty producers differ greatly from the traditional forest product industry which mass produced standardized products of relatively low value in large, capital intensive mills.

The remanufacturing industry in British Columbia has not only been viewed as a method by which to increase the value of provincial exports. In addition, the government has emphasized the need for a remanufacturing industry in order to increase the flexibility of the forest product industry as a whole and to enable the province to react more quickly to international competition and market demand. In a sense, the remanufacturing industry, heralded as a 'flexible industry', has been viewed as a method for the forest industry and

province as a whole to escape the dilemma of the staples trap and diminish the threat of economic depression caused by an inflexible industrial base.

The Research Question

The term 'flexibility' has been used in the literature to describe new developments in technology, changes in industrial organization expressed through the increased importance of a social division of labour, and the restructuring of labour relations. However, much of the research that has emerged over the past decade has focused upon one specific conceptualization of flexibility in a handful of regions and industries. Furthermore, the majority of academic attention has been paid to areas previously untouched by Fordist production methods. As Gertler (1992) notes:

> In reviewing much of the literature on the flexibility debate, one cannot help but be struck by the insistence of individual authors to focus their inquiry on particular places but not others...[for example]...most of the enthusiasts are based in more 'fortunate' surroundings, or have done the bulk of their fieldwork there; Scott, Storper, Saxenian and Walker are all in California; Piore, Sabel, *et al* work in Italy and Germany, (p. 267).

This thesis endeavors to respond to Gertler's concern by debating the meaning of flexibility within the context of the remanufacturing industry of British Columbia. Such a focus is different from previous studies because it involves *in situ* restructuring of an industry previously exemplifying Fordist production techniques and utilizing a relatively immobile resource. This thesis attempts to answer the following question:

In what sense does the remanufacturing industry of British Columbia exhibit flexible specialization?

Underlying this broad research question are the following subquestions:

- In what sense does the remanufacturing production system exhibit flexible labour practices?

- In what sense is production within the remanufacturing industry contingent upon, and impacted by, flexible technology?

- To what extent does the Lower Mainland of British Columbia represent a remanufacturing 'industrial district'?

It is hoped that in attempting to answer these questions this thesis will add to the existing research that has occurred on the 'flexibility' issue, particularly by helping to clarify the characteristics of 'flexible specialization', whilst at the same time uncovering some of the inevitable complexities involved with an emerging method of accumulation. Furthermore, it is hoped that the evidence portrayed in this work will aid in clarifying and critiquing the direction in which the present forest policy in British Columbia is attempting to lead the industry.

Research Design

Pondering the most effective method of studying the suspected emergence of flexible specialization, Hirst and Zeitlin (1992) state that:

> the preferred form of evidentialization for flexible specialization is...the analytical case study conducted at the micro-level of particular firms, regional economies or industrial sectors. Only detailed case studies permit the close attention to context and strategy which is the hallmark of a flexible specialization approach; and only this method makes possible the comparative analysis of relationships between forms of production and institutional frameworks which is central to its theoretical architecture, (p. 101).

Consequently the research upon which this thesis is developed was carried out through an in-depth, case study analysis of individual firms, operating within the production system of the remanufacturing industry, located in the Lower Mainland region of British Columbia.

These in-depth case studies of firms are complimented by sectoral data from a number of government in-house reports and studies by consultants (Industry Development Division - Industry Science and Technology Canada, 1989; McWilliams, 1991; Price Waterhouse, 1992a, 1992b). These report both on the need for value-added in British Columbia and also provide aggregate data on the remanufacturing industry as a whole. Using these sources, aggregate information is obtained on the significance of the remanufacturing sector in British Columbia, on characteristics such as the number and size of remanufacturing firms, value of outputs, the location of firms, materials used, products produced and markets serviced, and associated changes including plant openings, closings and locational changes. The information gathered from these reports is presented in Chapter 3 which gives a broad description of the remanufacturing industry, individual firms and ongoing changes.

However, as Hirst and Zeitlin point out, "only detailed case studies permit the close attention to context and strategy which is the hallmark of flexible specialization" (1992, p. 101). It is my belief that an over-reliance upon aggregate data would result in inconclusive and superficial evidence and would not lead to an understanding of the intricacies, problems and causes of restructuring. Moreover, given the on-going restructuring of the forestry sector and the dynamism of the remanufacturing industry it is anticipated that changes in these characteristics may well be occurring and may only be revealed by in-depth investigation of individual firms through a case-study technique. In choosing a case study methodology I follow the lead of many researchers who attempt to shed light on the emergence of flexible specialization. For example, in studying the technological aspects of flexible specialization, Schoenberger approached the problem "via the study of individual firms in order to achieve a more nuanced understanding of how they work out their strategies in practice" (1989, p. 233). In studying the restructuring of the British Columbia economy, Hayter and Barnes chose a case study methodology, noting that "that the advantage of this intensive strategy is that it reveals the specific causal mechanisms at

work" (1992, p. 347). This approach differs to that of Scott and Kwok (1989) who favour the use of a questionnaire technique in order to investigate a large sample of firms. It is my view that such an approach is insufficient when attempting to understand the rationale underlying flexibility, where decision making is often complex, nuanced and subjective.

Case study firms were chosen through consultation with representatives of industry agencies (Council of Forest Industries, British Columbia Wood Specialties Group) and from the information provided by industry directories ('The British Columbia Producer of Manufactured and Specialty Wood products Directory', Publ. Industry Science and Technology Canada, 1989; 'Products and Services Directory', Publ. British Columbia Wood Specialties Group, 1992). Since the emergence of a flexible production system is associated with the increasing utilization of a social division of labour, whereby each firm performs a specific stage of the production process, a wider variety of firm experience may be expected than in a more Fordist production system. Consequently, I decided to obtain information from several firms which exhibit a range of experience, size and strategy, rather than simply rely on 'one' case. Bearing in mind the depth of information required and the inevitable limitations imposed by time and finance, seven firms were chosen and asked to participate in my investigations. All complied. Firms were chosen in order to provide a range of experience, potential and insight into the evolving remanufacturing production system. Two subsidiaries of large corporations were interviewed since the parent firm holds tenure cutting rights to provincial crown forestry land and therefore may exhibit contrasting strategies to achieve flexibility than independent firms with less reliable fibre sources. Thus the firms chosen included two subsidiaries of large corporations and five small, independent firms. These firms provided examples of 'innovative' firms, 'complacent' firms, new firms and established firms. In total the research focused upon seven firms, each of the above criteria being met at least once, often with more than one criteria being appropriate for a single firm.

For each case study an attempt was made to speak to the owner or manager. Within these predominantly small owner-managed firms, speaking directly to either the owner or the manager (in practice often the same person) was important in order to obtain the depth of understanding required to answer questions on issues which are often complex and based upon subjective decision making. No attempt was made to interview remanufacturing workers, in part a reflection of the 'strategy' thrust of this work, and also a reflection of limited time, resources and the lack of a spokesperson in many of these non-union environments. This emphasis upon management decision making is reflected in interview evidence where the implications of unionization are those perceived by management (largely offering an anti-union perspective). This management perspective is viewed as acceptable since this thesis does not attempt to evaluate the affect of unionization upon labour flexibility.

In an attempt to understand the dynamism and intricacies of the remanufacturing production system an open-ended interview structure was used. By 'open-ended' it is meant that the questions asked of the interviewees were not proposed by a fixed questionnaire, nor were the questions necessarily asked in the same order or wording, although each interview covered the same set of topics. Issues were raised and discussed, with the nature of the subsequent questions depending in part upon the response of the interviewee. It is believed that such an open-ended interview technique results in a deeper understanding of the topic being studied through encouraging the interviewee to emphasize the more significant issues affecting the industry and to accentuate the significant aspects involved in the production process from his/her decision making perspective. Through the use of open-ended, in-depth interviews the results are in part a reflection of the obvious subjectivity of the researcher. However, it is believed that such an open ended approach allows the values and opinions of the decision maker to be expressed whilst allowing issues to be freely pursued and discussed without the constraints imposed by a formal questionnaire technique.

Interviews were structured through the use of a 'brain-storming sheet' consisting of the main issues thought to be of importance prior to the interview. This structure allowed latitude for follow up questions to be asked where appropriate. The specific questions asked in the case study interviews were guided by the objectives of the thesis outlined earlier and were structured around industrial organization (supplies, markets and contracting), labour relations, technology (investment) and inter-firm relations. A copy of the interview structure is contained in the appendix. However, a brief overview of the topics is provided here.

To ascertain the impact and utilization of technology in the remanufacturing industry each firm was questioned on the capital investment in their plants over time, the type of technologies introduced into the production process, how the technologies are used and how they benefit the firm, the impacts of investment upon labour, the utilization of computer technology, and the importance of research and development to the firm. Where firms failed to take advantage of available technologies there was an attempt to discover the reasons why.

In order to measure the existence of flexible specialization within the remanufacturing industry of the Lower Mainland information was collected on the size of each firm interviewed, both in employment and output terms, along with the location and age of each firm. In order to assess the degree of vertical disintegration, material and information flows between firms were investigated in terms of backward and forward linkages. In particular, information was sought on the firm's source of fibre, the amount consumed over time, the number, location and function of suppliers and the formality and duration of contracts with suppliers, possible sub-contracting agreements and the nature of these, and any significant changes over time. Additional information was sought on the location and characteristics of the firm's markets, the contracting out of work to other remanufacturing firms, the nature of the job carried out, the reasons for contracting the work out, and the formality and duration of contract. Furthermore, the supply and

inventory system of the firm was investigated to reveal the importance of Just-In-Time delivery.

To assess the extent of labour flexibility, employment characteristics were investigated for each firm. The degree of functional flexibility was investigated through issues such as variations in wages, the significance of job demarcation, level of unionization, the importance and method of training, type of employee skills, the seniority, promotion and layoff systems. To assess whether workers were numerically flexible, issues such as the sex of employees, their roles within the firm, the significance of part-time and temporary workers, the use of consultants and specialists from outside the firm, job security, employee turnover and training were addressed. Finally, to discover whether workers were financially flexible the firm were questioned on the sex, age, pay level and position of workers in the firm. Each firm was also asked about their method of employee enrollment in order to evaluate the importance of labour market segmentation.

In order to assess the significance of inter-firm relations and the development of the Lower Mainland as a remanufacturing industrial district each firm was asked about the nature of contact with other wood product firms, and the extent of interaction between firms in order to share ideas, training and form research alliances. Furthermore, each firm was questioned on their use of outside firms for services related to their production in order to measure the extent to which certain 'peripheral' tasks have been externalized. In conjunction with questions posed to remanufacturing firms, industry agencies were questioned as to the nature of their role, membership and impact upon the remanufacturing industry in the Lower Mainland in an attempt to assess the function of industry agencies and their importance in the creation of an industrial district.

Finally, firms were questioned on how they viewed the future for the firm in terms of products, technology, markets, location and employment so as not to miss on-going plans which may change the operation of the firm and the production system as a whole.

Thesis Organization

The writing up of data extracted at the aggregate level from reports, and at the micro-level from case study interviews, is structured by the objectives of the thesis in a way so as to most clearly express the nature of the emerging production system of the remanufacturing industry. Chapter 2 reviews the concepts of flexibility and the industrial district from the perspective of economic geography. The subsequent three chapters are concerned with the nature of the emerging production system of the remanufacturing industry. Chapter 3 describes the structure of the remanufacturing industry in British Columbia, and the Lower Mainland in particular, through the use of secondary data and information obtained through case-study investigation of remanufacturing firms, and interprets this structure from the perspective of the concept of flexible specialization. Chapter 4 presents the results of case study interviews with independent remanufacturers in an attempt to understand the variety of strategies within the production system and what implications these strategies have for the nature of flexibility. Chapter 5 investigates the implications and strategies involved in the pursuit of flexibility in two, large, 'tenured' forest product firms. Chapter 6 evaluates the significance and contribution of inter-firm relationships and industrial agencies, and assesses the degree to which the Lower Mainland represents a remanufacturing industrial district. Finally, concluding thoughts are presented in chapter 7, evaluating the extent and potential benefits of flexible specialization in the remanufacturing industry of the Lower Mainland and the implications of a potential re-emergence of industrial districts for industrial location, regional development and trade.

Chapter 2

Notions of Flexibility and the Concept of the Industrial District

The recession and subsequent restructuring evident in the capitalist economies of North America and Western Europe over the last decade has been viewed by many commentators as a watershed in the method of accumulation. Although the meaning of the terms are debatable, this watershed has been labelled as a shift from Fordism to post-Fordist production methods, the latter associated with the emergence of the strategy of flexible accumulation.

With the abundance of research investigating the restructuring which occurred over the last decade, the term 'flexibility' has emerged as a popular catchphrase. However, there exists little consensus as to what is meant by 'flexibility'. As Sayer notes, "the trouble with concepts like Fordism, post-Fordism and flexible specialization is that they are overly flexible and insufficiently specialized" (Sayer, 1989, p. 666). For some, flexibility describes the benefits offered by new computer assisted technologies such as computer aided design (CAD) and manufacture (CAM) (Schoenberger, 1987). For others, it refers to the advantages of a new form of industrial organization based upon a new 'social division of labour' (Piore and Sabel, 1984; Scott and Storper, 1992), whilst others refer to flexibility in reference to changes in labour - management relations (Atkinson, 1984). An even larger range of definitions for 'flexibility' have been reviewed by Gertler (1988). But flexibility remains a major theme of contemporary restructuring literature. Thus, for Harvey, the emergence of 'flexible accumulation' is "marked by a direct confrontation with the rigidities of Fordism. It rests on *flexibility* with respect to labour processes, labour markets, products, and patterns of consumption...[and has given rise to]...entirely new industrial ensembles in hitherto underdeveloped regions (such as the 'Third Italy')" (Harvey, 1989, p. 147, emphasis mine).

The objective of this chapter is to review the most prominent interpretations of flexibility and to discuss the spatial implications of a move from Fordism to post-Fordism or 'flexible production'. The chapter begins with a brief overview of Fordism, focusing particularly on the technological, organizational and labour characteristics of Fordist production. The second section addresses the impact of new, 'flexible' technologies upon production, and the implications for industrial organization and labour, with spatial implications brought to light where appropriate. The third and final section focuses specifically on the spatial implications of flexibility, with specific attention given to the issue of the re-emergence of industrial districts.

Fordist Production

The post-war boom experienced by the major capitalist economies of North America and Western Europe has been viewed by many as exemplifying a specific form of accumulation, labelled Fordism. The concept of Fordism first emerged through the production practices forged by Henry Ford in the second decade of this century. However, many of the impacts associated with Fordist production can be seen as partly founded upon the scientific management techniques devised by Taylor. A key feature of scientific management was the time and motion study of work tasks. To maximize the efficiency of the individual worker, Taylor reduced the role of labour to simple tasks and divided labour from management. As such "all possible brain work [was] removed from the shop and centered in the planning and laying out department...[permitting]...the use of comparatively cheap men even in complicated work" (Taylor, 1903, p. 98, 105). Henry Ford applied these Taylorist principles, along with automation, to enable mass production of automobiles. Through the use of task-dedicated machinery and repetitive worker tasks Ford created production lines for the manufacture of standardized products. The proliferation of these production methods throughout western economies, especially the United States, has resulted in the term 'Fordism' being used as a label for what Scott and

Storper term a specific 'technological-institutional system' (Scott and Storper, 1992, p. 6), a system with distinctive characteristics in terms of investment, industrial organization and labour-management relations.

Fordism is based upon the principles of mass production and mass consumption, whereby production occurs in long runs in order to achieve economies of scale, thereby minimizing the cost per unit product. As Jessop (1992) notes, Fordism involves, "a virtuous circle of growth based upon mass production and mass consumption" (p. 47). Thus, as an historically defined period of growth, perhaps most evident in the United States, the Fordist technological-institutional system involved rising productivity due to investment in task-dedicated machinery and increasing economies of scale, rising incomes due to wages linked to productivity, increased demand made possible by improved disposable income, and increased corporate profits allowing further investment aimed at increasing productivity. It may be argued that this method of accumulation, based upon the mass production of standardized products, is largely dictated by technological imperatives which in turn affect the nature of industrial organization. The use of standardized, task-dedicated machinery promotes the concentration of capital into a few, large, vertically integrated corporations due to the capital required to achieve economies of scale in production. As such, the ideal-typical Fordist enterprise is large, multi-divisional, often multi-national and monopolistic, manipulating the market by ways of advertising and inter-corporate collusion wherever possible (Knickerbocker, 1973).

In addition, the Fordist technological - institutional system is associated with distinct labour - management relations. With the use of task-dedicated machinery along an assembly line, production work is largely reduced to the performance of repetitive tasks, often requiring little training, whilst decision making is largely isolated within management and thus separated from the shop floor. As such, labour under Fordism is segmented into an hierachical, 'dual labour market' (Averitt, 1968; Cooke, 1983). In particular, in Fordist production, employment within large firms is divided into a primary segment (further

Figure 2.1 - The segmentation of labour under Fordism

	Primary Segment		Secondary Segment
	independent	subordinate	
job stability	high due to expensive replacement cost and chances for promotion	structured according to union seniority 'first in - last out'	low, cheap to replace due to low skill and informal labour market
skill level	advanced education, firm specific training and know-how	'blue collar' skills 'on-the-job' training, some apprenticeships	variable, blue collar skills, on-the-job training
pay	high, salaried, stable	high via collective bargaining, indexed to productivity	low
non-wage benefits	high	high through union - management collective agreement	low in order to minimize cost
advancement	within the primary segment	according to union seniority (except for trades)	high but within segment

Based on Averitt, 1968

divided into independent and subordinate) and a secondary segment. Each segment is distinguished by varying levels of job security, skill and training, wages and associated benefits, opportunities for advancement and working conditions (see Figure 2.1). In general, primary independent jobs are 'white collar' (management) secure jobs and employees are regarded as professionals who are educated and paid high salaries, non-

wage benefits and who enjoy good chances of promotion as well as high levels of job responsibility. These primary independent workers typically receive considerable firm-specific training and are expensive to replace. As such these workers are rarely affected by fluctuating economic conditions. Primary subordinate workers are 'blue collar' workers, possessing job specific skills attained through informal on-the-job training and experience over time. As Doeringer and Piore (1971) note, "for blue-collar manufacturing jobs, the hallmark of on-the-job training is its informality...[via a process that may be described as]...'osmosis' or 'experience'. Very often on-the-job training is not recognized as a distinct process at all; it is simply assumed that a worker who has 'been around' for a while will know how to do certain things" (Doeringer and Piore, 1971, p. 18). These workers are rewarded with good wages, which are related to productivity and non-wages benefits; they are highly unionized, with job security and promotion dictated through a union seniority system. However, Doeringer and Piore suggest that demand for the job specific skills possessed by primary subordinate workers is diminished by investment in technology. As noted, in the United States at least, "engineers appear to favour job simplification and the substitution of capital for labour wherever decision processes permit...[T]his implies a general bias towards 'labour saving' and skill saving' technologies" (Doeringer and Piore, 1971, p. 99). Workers in the secondary segment of this dual labour market, according to Doeringer and Piore, are labourers, often requiring little or no skills, with low wages, little chance of promotion and a low level of job security. Since the workers in the secondary segment require few skills and the skills which are required are widely available throughout the majority of local labour markets, the search for employees is informal and cheap. In economic downturns these workers are often laid-off and are continually threatened with replacement by fixed capital.

The segmentation of workers in this way also has implications for the geography of production. The deskilling of labour, especially workers in the secondary segment, through the fragmentation of production into simple tasks, allowed the Fordist enterprise

freedom from the geographical constraints associated with a reliance upon a relatively skilled labour force. Consequently, the production process could be dispersed over space in order to minimize cost and, in the latter stages of Fordist production, to offset worker militancy in established locations. This 'spatial division of labour' initially occurred at the regional level, with occupational categories within the corporate hierarchy such as headquarters, research and design, and production located in areas best suited to corporate needs (Simon, 1960). However, as Fordism "hit technical and social limits, reflected in declining rates of productivity growth and increasing resistance from workers...firms increasingly sought to incorporate new sources of labour in the periphery in the low-skilled segments of the production process, thus extending the spatial division of labour" (Schoenberger, 1987, p. 200). This extreme form was expressed as a 'new international division of labour' (Fröbel *et al*, 1980). Consequently, the technological-institutional system labelled Fordism has been associated with specific forms of industrial organization, labour segmentation and geography.

The Emergence of Flexible Production

The early 1980's marked a period of crisis in Fordist production. Within the capitalist economies of North America and Western Europe a series of internal and external pressures resulted in the recession of the early 1980's. The industrial restructuring which followed has sought to re-establish conditions under which accumulation was again viable. The new method of capitalist accumulation that has emerged has been variously described as post-Fordism, flexible specialization, or flexible accumulation. For Gertler, "at the heart of this supposed revolution in production methods is a new generation of qualitatively distinct fixed capital", replacing the *fixed* capital of Fordism (Gertler, 1988, p. 420). The use of Fordist, task-dedicated machinery and semi-skilled assembly workers to produce standardized products is satisfactory in a period of stable, homogeneous market demand. Under such conditions, the quantities of production required in order to justify fixed capital

investment can be met through economies of scale. However, in times of market fragmentation and dynamism, task-dedicated machinery becomes inefficient since economies of scale become harder to attain and 'rigid' technology imposes an inertia upon product mix. Consequently, during the restructuring of the 1980's, the rigid, task-dedicated Fordist machinery was increasingly replaced by flexible, multi-purpose technology.

Flexible technology features robots and computer numerically controlled (CNC) machines capable of "producing a variety of new products, or old products in new ways" (Gertler, 1988, p. 420). The ability of flexible machinery to change quickly from one operation to another reduces down time and therefore increases the utilization of fixed capital. Furthermore, the reprogrammable nature of flexible technology means that "their productive life now extends over several model changes, significantly lengthening their amortization period" (Schoenberger, 1987, p.205). The increased life span of flexible machinery and the ability for machines to be reprogrammed to perform a variety of tasks allows firms to manufacture a variety of products without sacrificing production efficiency. Through the ability to switch production from one product to another, firms become less susceptible to changes in demand, and are able to serve more diverse tastes due to economies of scope. As such, flexible machinery enables firms to be more flexible in product mix, serve niche markets due to the lack of constraints imposed by economies of scale and standardization, and react quickly in times of economic downturn. For example, in the forest product industry of British Columbia, the implementation of flexible technology has allowed firms to serve more diverse markets through the production of a wider variety of high quality products (Barnes *et al*, 1990).

The introduction of flexible technology has implications for industrial organization. For example, the use of computers and telecommunications has increased the efficiency of inventory control and revolutionized supply delivery systems through what is termed the 'Kanban' and 'just-in-time' system. Furthermore, the increased utilization of supply

systems and inter-firm communication has increased the importance of local inter-firm linkages, often resulting in a 'social division of labour' whereby production occurs through the culmination of processes carried out between a small number of firms rather than within a single, integrated corporation. For Scott and Storper, the impacts of flexible technology have resulted in the vertical disintegration of production and an associated increase in organizational flexibility.

Industrial Organization

In the restructuring of Fordist production, the shift towards more flexible technology has been associated with more flexible forms of industrial organization. Streek (1991) notes that the industrial restructuring of the past decade has been characterised by the "sophisticated application of information technology, a diversified product range, and non-price-competitive marketing strategies" (1991, p. 25). The emphasis upon quality rather than price, and product diversity over standardization, has made possible new production strategies. Distinguishing between standardized-price and customized-quality competition, and high and low volume production, four strategies may be identified (see figure 2.2).

Figure 2.2 - Possible production strategies in a period of post-Fordist production

	Form of Competition	
	Standardized price- competitive	Customized quality-competitive
High volume	Fordist production	'Flexible Mass Production' external - e.g. Toyota internal - e.g. MacMillan Bloedel, Chemainus
Low Volume	small firm serving local market with commodity goods	vertically disintegrated production system e.g. CBI, cutlery in Tsubame

Firms pursuing a high volume, standardised-price competitive production strategy have traditionally been labelled Fordist and have been discussed earlier in this chapter. A low volume, standardized-price competitive production strategy is indicative of small firms producing commodity goods for highly localized markets. In this strategy, the low level of demand limits the volume of production and the size of firm. The remaining two strategies have received increased attention over the last decade as much of the industrial growth has emanated from firms pursuing such 'flexibly specialized' strategies.

Low volume, customized-quality competitive strategy -

Firms pursuing a low volume, customized-quality competitive production strategy (previously associated with 'craft production') have emerged as significant contributors in the clothing industry of the 'Third Italy' (Piore and Sabel, 1984), the electronics industry of Southern California (Scott and Kwok, 1989), and the cutlery industry of Japan (Hayter and Patchell, 1993). This strategy is largely characterized by low production volumes, the vertical disintegration of production into small and medium sized enterprises (SME's) and the external flexibility of the production system afforded by the utilization of a social division of labour. As Storper and Scott (1989) suggest, in a period of flexible specialization the use of flexible forms of technology and labour diminish the benefits of internal economies of scale and size. As a result, processes become externalized, that is, tasks previously carried out 'in-house' are contracted out to other firms, resulting in the vertical disintegration of production. Due to the externalization of production, a social division of labour emerges where firms rely upon subcontractors for supplies and services. The economies of scale achieved by vertical integration in the Fordist firm are replaced by internal economies of scope through flexible technology and labour, with an increased focus upon batch production. Vertically disintegrated firms benefit from external economies of scale through the use of a multi-firm production system where each firm specializes in a certain production process. As a result "flexibility is multiplied by the

system effects of the social division of labour, which permits the formation and re-formation of interdependent combinations of producers", thereby creating 'external flexibility' (Storper and Scott, 1989, p. 24). This internal and external flexibility affords the individual enterprise the flexibility to deal with a fragmented and dynamic market and the associated fluctuations in demand. Thus, "when changes in economic conditions bring about intensified uncertainty and instability in production and increased competitiveness in final markets, then internal economies of scale and scope within the firm begin to break down so that the entire production system is liable to display strong symptoms of horizontal and vertical disintegration" (Scott, 1988, p. 176).

The flexible "customized" enterprise does not depend upon economies of scale through mass production techniques. Rather flexible specialization takes advantage of economies of scope, producing a variety of different products in small batches using flexible technology, with an emphasis upon quality and customer requirements rather than standardization and cost minimization. Furthermore, the rigidities associated with Fordist labour-management relations and unionization are diminished with the use of flexible labour practices and a weakening of organized labour. Through this 'internal flexibility', the flexibly specialized manufacturing enterprise has the ability to "shift promptly from one process and/or product to another, and to adjust quantities of output rapidly up or down over the short run without any strong deleterious effects on levels of efficiency" (Storper and Scott, 1989, p. 24). Where economic conditions reduce the demand for a specific product, the firm is able to switch to manufacturing other products by reprogramming the technology. As such, the detrimental impacts of brief fluctuations in demand are minimized.

However, despite the emphasis many commentators place upon flexible technologies such as CAD/CAM systems (Gertler, 1988; Storper and Scott, 1989), the applicability of flexible technologies for all manufacturing firms has been questioned. For example, Kelley and Brooks found that the use of flexible technology was most prevalent

among large, diversified firms, the adoption of such technologies being quite rare in enterprises with less that 500 employees (Kelley and Brooks, 1988). Moreover, Schoenberger (1989) suggests that flexible technologies are "most appropriate for output volumes of 20,000 units per year or more, while for parts being produced at annual volumes of 200 units or less, unautomated, general purpose machinery is still the best practice" (p. 234). This evidence would seem to contradict the view by Piore and Sabel that the quintessential flexible firm, one employing the latest flexible technologies, is inevitably small. Rather, the evidence presented by Schoenberger, and Kelley and Brooks, underlines the applicability of general, multi-purpose, low-technology machinery as the best option for small firms in a social division of labour. In this sense, flexibility is derived through the low batch production of customized products by varying the set-up of low cost, multi-purpose machinery within the small firm, and performing processes which high technology firms cannot.

A good example of the low volume, customized-quality competitive production strategy is the 'community based industry' or 'flexible network'. Community based industries comprise mostly small producers interconnected by complex and constantly changing linkages (as exemplified by the California electronics industry or the Japanese cutlery industry). Community based industries (cbi's) "are localized, inter-linked concentrations of small businesses which manufacture a distinct product, usually a consumer good, on the basis of a social division of labour" (Hayter and Patchell, 1993, p.xx). Such community based industries are more widespread than often thought and, for example, in Japan they account for one-tenth of all small businesses (Yamazaki, 1980, cited in Hayter and Patchell, 1993).

What advantages do these community based industries posses in order to allow their existence in a highly competitive market characterized by large firms? It would seem that through specialization in a certain process or product, combined with the flexibility to serve a variety of specific market demands, these small businesses offer other firms in the

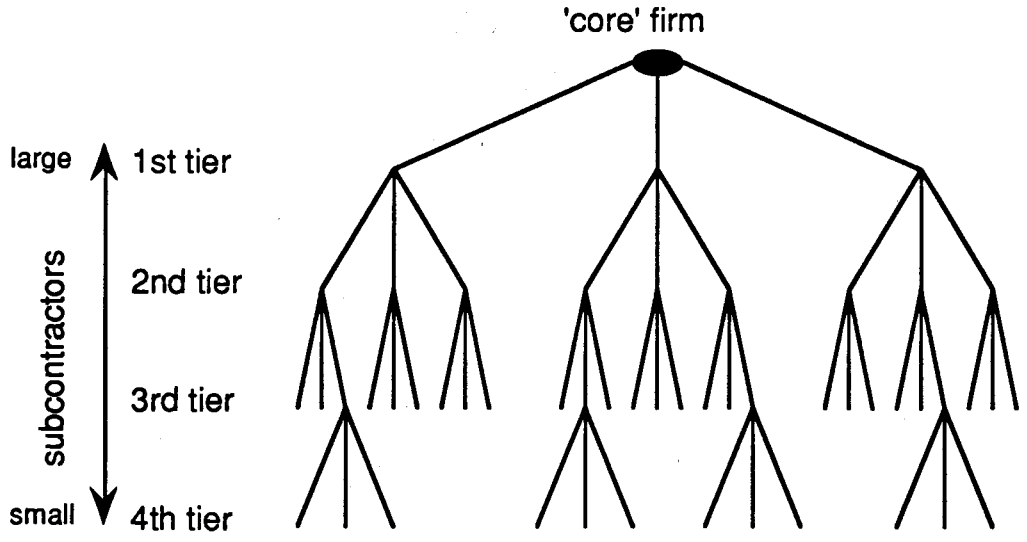
social division of labour quality, cost and speed advantages that could not be obtained in-house through vertical integration. Firms in this production system therefore take advantage of external economies of scale by utilizing the specialized skills of other small firms in a related industry, each firm specializing in one particular stage of the production process. The cutlery industry of Tsubami, Japan, has been cited as an example of a community based industry, where production is "organized by a highly diverse and large group of small, specialized firms integrated most obviously by a dense network of input-output linkages...involving such activities as grinding, buffing (polishing), plating, moulding and blade manufacture" (Hayter and Patchell, 1992, p. xx).

High volume, customized-quality competitive strategy -

Over the last decade, some large, previously 'fordist' firms have invested in information technologies and re-organized labour in an attempt to produce a diverse range of high quality products whilst retaining high volume production. This strategy has been termed 'flexible mass production' (Sabel, 1991) and is evident in the automobile industry (Sayer, 1989) and forest product industry (Hayter and Barnes, 1992). Such flexibility is evident in two organizational forms, an hierarchical 'external flexibility' structure where a high level of contractor-subcontractor relationships exist (for example, automobile production in Toyota Town, Japan) and the 'internal flexibility' structure (for example, forest product manufacture in Chemainus, British Columbia).

In an hierarchical form of flexible mass production, a large 'core' firm is served by tiers of smaller subcontractors, (see Figure 2.3). A good example of an hierarchical flexible production system is the Japanese automobile industry. This industry is organized into a handful of major firms and hundreds of supplier-subcontracting firms organized into three or sometimes four tiers. To varying degrees each major firm at the top of this hierarchy acts as a parent to the subcontractors below, often aiding in financing, technology and management decisions (Dore, 1987). Organized into an hierarchy, subcontractors

Figure 2.3 - 'Hierarchical' production system



Source: Sayer, 1989

often serve only the one contracting firm, especially at the lower tiers, producing a high degree of dependency, interaction and mutual respect. (I use the terms contractor and subcontractor in accordance with existing literature, although frequently no formal, legally binding contract exists in such business interactions). Often the major company at the top of the hierarchy will relinquish management control over all suppliers, giving the first tier suppliers responsibility for purchasing decisions from the second tier subcontractors, "vertical disintegration is therefore complemented by strong, but highly stratified, vertical organization...so as to control quality" (Sayer, 1989, p. 685).

Within this hierarchical system, the nature of the business relationship between core firm and supplier is not uniform. First, the suppliers are generally more dependent upon the contractors above them in the hierarchy than vice-versa. Second, where technologically sophisticated products are produced, subcontractors may vary in their relationship to the core firm according to what Asanuma calls 'relation specific skill', that is, "the skill

required on the part of the supplier to respond to the needs of the core firm" (1989, p. 21). For example, subcontractors serving the robotics firm Matsushita are divided into 'design approved' and 'design supplied' firms depending upon technological capability, with the former less dependent upon the core firm than the latter (Patchell, 1993). In this way, the hierarchical production system comprises forces of competition and cooperation, with the relationship between core and supplier a reflection of technological capability, quality of product, and subjective feelings of trust and mutual respect. The use of subcontractors to perform either highly specialized production or unsophisticated volume production allows the core firm to concentrate upon the latter stages of production, such as automobile assembly. Furthermore, the ability of subcontractors to be utilized in various combinations allows the core firm to manufacture a diverse product mix through batch assembly. In this way the large firm attains external flexibility and is thus is able to manufacture large volumes of customized-quality competitive products.

The latter form of flexible mass production is attained through the internal flexibility of the large firm. Through investment in highly sophisticated, flexible technologies, large firms are able to produce a variety of products in large volumes by re-programming computer assisted manufacturing systems at the end of each batch of production or programming the computer system to manufacture the most appropriate product to suit demand. An example of internally flexible mass production is the MacMillan Bloedel sawmill at Chemainus, British Columbia. Due to antiquated technology and high labour costs the sawmill was closed down in 1982 but was reopened in 1984 after a $22 million dollar overhaul. In place of the old, task dedicated machinery came state of the art computer systems. As Barnes *et al* (1990) note, "the new machinery consisted of numerically-controlled machine tools which enabled greater flexibility in producing higher-value products and in serving more diverse markets. In particular, the plant shifted its emphasis from construction-grade lumber in limited size to high-grade lumber of various

dimensions" (p. 158). Thus through in situ investment into flexible machinery the firm attained internal flexibility which permitted flexible mass production.

It may be noted that although the terms high and low volume production are used to provide a basic distinction from the perspective of flexibility, the boundaries between what is high volume production and what is low volume production is not always clear. In automobile production, for example, Toyota concentrates upon the production of several car models, manufacturing cars in large volumes. However, the variety of 'add-ons' available to the consumer results in a product diversity so that specific cars are manufactured in batches, thus constituting low volume production. Furthermore, the Chemainus sawmill produces lumber in high volume but individual dimensions and grades of lumber in relatively small batches. A similar predicament may be envisaged where a small subsidiary of a large firm specializes in manufacturing a single customized product. To the large firm, this strategy might constitute low volume production, yet at the scale of the individual plant production occurs in large volumes.

Labour

The increased use of flexible technology such as reprogrammable, computer numerically controlled machines and artificial intelligence has been associated with a decrease in the mass production of standardized products. For many, this decline of Fordist production techniques, including in its most extreme form, the utilization of 'deskilled' workers for simple repetitive tasks, signifies a watershed in the labour process. In contrast to fordist machinery, flexible technology reinstates the importance of skill, at least to some extent, with certain workers expected to oversee a variety of different machines and have the ability to perform at least minor repairs and adjustments to correct any problems associated with the machinery. At the same time, other workers have been increasingly removed from the production process as flexible technology performs some of the more repetitive tasks and quality testing. In contrast to the high level of job demarcation associated with Fordist

production, some workers in this 'new economic reality' are expected to be more flexible, to have knowledge of a variety of jobs and to have problem solving skills to enable them to work independently of management. Consequently, changes in technology and industrial organization during the 1980's have been accompanied by qualitative changes in labour requirements and labour - management relations.

Based upon research into manpower management decisions in the United Kingdom, Atkinson (1984) argued that the layoffs during the recession of the early 1980's, and the associated change in enrollment and labour deployment, has undermined the assumption of traditional segmentation theory. During the recession, not only were primary dependent workers made permanently redundant but for the first time white-collar workers were significantly affected. Atkinson has argued that in response to the restructuring of the 1980's a new form of labour segmentation has emerged based upon flexibility in order to adapt to demands of new technology, production methods, uncertainty and market dynamism. Furthermore, Atkinson argues that these changes in labour segmentation represent "a significant break with the conventional, unitary and hierarchical internal labour markets...[and signify]...a new model for firm's organization of their labour forces which we can expect to develop more strongly in years to come" (Atkinson, 1984, p. 3). So what are the nature of these changes?

The emerging model of labour relations is that of horizontal segmentation into a core (functionally flexible) and periphery (numerically and financially flexible) workforce (see Figure 2.4). The core 'functionally flexible' workers possess firm specific, organizational skills. Functional flexibility is sought so that workers can be deployed quickly and smoothly between activities and tasks, workers requiring multi-faceted or 'polyvalent' skills in order to tackle a variety of assignments. As Atkinson points out, "as products and production methods change, functional flexibility implies that the same labour force changes its activities with them" (Atkinson, 1984, p. 11). As such managers, designers, technicians and craftsmen acquire employment security through the acceptance

of functional flexibility, often requiring cross-trade working, reduced job demarcation and hence job security, retraining and multi-skilled project teams, with the emergence of job rotation schemes (Atkinson, 1984, p. 15, also see Storper and Scott, 1990, p. 576-77). Associated with these polyvalent skills comes increased job responsibility and an emphasis upon 'trouble shooting', these skills being a necessary component of flexible production systems.

Consequently, production workers have become increasingly responsible for quality control. Many of the features of a functionally flexible workforce are already developed in Japan. For example, Toyota workers are organized into 'quality circles' in order to monitor the quality of the product being produced and the work being performed by their colleagues. Furthermore, Toyota workers are given a switch empowering them to turn on 'Andon lights' to close down production if a defect is detected (Hoffman and Kaplinsky, 1988). Core workers are also given responsibility for process innovation, with suggestion schemes commonplace in many Japanese factories. These core workers are therefore characterized by a high level and variety of skill, with increased responsibility, and are rewarded with employment security and high wages in the form of salaries and non-wage benefits.

The peripheral workforce is comprised of numerically and financially flexible workers. Numerical flexibility is sought so that "worked hours can be quickly, cheaply and easily increased or decreased in line with even short term changes in the level of demand for labour" (Atkinson, 1984, p. 11). There are two main ways that numerical flexibility may be achieved. One the one hand, managers can hire and fire workers in accordance with changes in demand. Managerial power in this regard is particularly evident in the case of temporary and part-time labour but is by no means restricted to these categories. However, numerical flexibility need not be associated with such harsh measures. Rather, the use of flexible shift patterns such as rostering, flexi-hours and on-call agreements may achieve similar goals. The use of flexible shift patterns may be limited

Figure 2.4 - Labour segmentation in a period of flexibility

	Core	Periphery	Periphe.
Nature of flexibility	Functional	Numerical	Financial
Security	employment security obtained by polyvalent skills	insecure	relatively low compared to core
Wages	high, indexed to multi-skills and job responsibility	low, non-wage benefits absent	low, limited non-wage benefits
Hours	full-time	part-time, temporary and contracted	full-time
Advancement	through polyvalent skills, ability and responsibility	marginal	limited within job description
Training	often advanced education, broad based, trouble shooting	little on-the-job training	little on-the-job training
Gender/Race	dominated in western economies by white males	minorities	minorities

Adapted from Atkinson, 1984

in practice since this approach is more likely to proceed with the same workforce as prior to restructuring, resulting in labour-management conflict in the early stages. As such, the most common form of numerical flexibility is the use of part-time and temporary workers, hired to perform either general tasks which require little skill, or specific tasks (most

commonly secretarial) in peak demand periods or when core workers are absent. The majority of part-time and temporary workers are either the young or old, with a proportionate over-representation of women (Christopherson, 1989). The final form of numerical flexibility is the use of sub-contracting tasks to workers outside the firm. Sub-contractors are generally used where work is either highly specialized (such as computer systems analysis) or very mundane (such as cleaning). This not only promotes numerical flexibility but also greater functional flexibility as sub-contractors are more specialized than the multi-skilled core workers within the firm (who are probably busy doing everyday work), and therefore may get the job done more efficiently. As such, numerically flexible workers provide the core functionally flexible workers with stability in times of fluctuating demand.

The other form of peripheral workers are characterized by financial flexibility which is sought so that pay and other employment costs reflect the state of supply and demand. This pressure is reflected in two ways. First, labour costs under Fordism were highly rigid and reflected a 'rate-for-the-job' system of pay rather than an assessment-based pay system (Atkinson, 1984). As such financial flexibility encourages new forms of pay scheme whereby "wage improvements are directly linked to the acquisition of supplementary skills. The principle behind wage payments are that workers are paid not for what they do, but according to what they can do", thereby promoting functional flexibility (Hoffman and Kaplinsky, 1988, p. 127). Second, and perhaps more significant, financial flexibility involves a drive towards decreasing labour costs through the use of 'marginalized' workers, that is females, the young and elderly, and ethnic minorities. Financially flexible workers may be full-time workers but enjoy relatively low employment security, "being offered a job, not a career" (Atkinson, 1984, p. 17). Thus, jobs performed are unlikely to be highly skilled or specific to the firm, thereby requiring little in- house training. The lack of career prospects combined with a recruitment policy often aimed specifically at women encourages a relatively high turnover rate, which consequently increases the level of

numerical as well as financial flexibility. As such, peripheral workers are characterized by an over-representation of marginalized groups, a relatively low level of skill (with the exception of specialized sub-contracting work), low employment and job security, low wages, a lack of non-wage benefits in order to keep labour costs at a minimum and a high rate of turnover.

Investigations of the impacts of industrial restructuring upon labour support Atkinson's suggestion that flexible forms of labour organization became increasingly important in the 1980's. For example, in Britain in 1981, of the 30 million citizens of working age, 17% were part-time workers, whilst only 53% were full-time employed workers (Atkinson, 1984). It may be little coincidence that in 1988 17% of the U. S workforce was also involved in part-time work (Christopherson, 1989).

Associated with these changes in labour segmentation, the labour relations scene in the United Kingdom and Canada has witnessed declining union membership and a consequent reduction in the bargaining power of unions to enforce employment conditions, wage and non-wage settlements that are unfavorable to employers. The result has been a decrease in job demarcation of the core workforce and a blurring of the boundaries between previously separate job functions. Furthermore, the lack of protection by unions for core and especially marginalized workers has caused many commentators to question the impacts of flexibility upon labour. The implications of flexible technology and the move towards a flexible labour force has caused anxiety for workers to the extent that flexibility has imposed "a greater share of adjustment to macroeconomic fluctuations squarely on the shoulders of workers" (Gertler, 1992, p. 268). Turnbull (1987) suggests that the just-in-time system of production is "a highly developed form of work intensification which belies any notion of job enrichment through teamworking, flexibility and job rotation claimed by the many proponents of JIT" (Turnbull, 1987, p. 8, cited in Tomaney, 1989, p. 35). For example, a move towards flexible production by Volvo in Sweden involved the replacement of Fordist assembly lines by a system of automatically guided vehicles (AGV)

and assembly in bays, a method termed 'dock assembly'. As Berggren notes, "at specified times the carriers started moving, monitored by a central computer, regardless of whether or not assembly workers were finished, thus constituting in practice an indexing line" (Berggren, 1989, p. 181). As a result workers were coerced into speeding up their rate of work in order to match the pace set by the new technology. Furthermore, the increased efficiency of the technology and the associated polyvalent skills required from workers may result in "the reduction of overall employment levels through the elimination of overmanning that results when workers are tied to specific machines, even when their output is not needed immediately" (Schoenberger, 1987, p. 207). It has been suggested that flexible technologies such as the use of robots and computer-controlled machinery typically replace between two and seven production workers, depending upon the application (Schoenberger, 1989, p. 235).

The implications of flexible technology for labour, production and industrial location are, at least in part, dependent upon the industry undergoing restructuring. In certain instances, such as where the industry is not tied to a resource, the imposition of flexible technologies may involve the relocation of production in an attempt to escape the possible inertia to change imposed by worker militancy. However, in industries tied to a relatively immobile resource such relocation is not always possible. In such cases, in situ restructuring towards flexible technologies and new forms of labour flexibility has some special features. Such characteristics are evident in the restructuring of the Chemainus sawmill in British Columbia. The introduction of flexible technology associated with in situ restructuring in the mid 1980's resulted in the number of production workers being cut by 80% and trades by 75% due in part to flexible technology and the associated polyvalent skills (Barnes *et al*, 1990, p. 159). Thus, such attempts to introduce technology into flexible production may constitute the intensification and regulation of the work force, as well as efforts to increase the variety and quality of product produced.

It should also be recognized that the introduction of flexible technologies, which often involves large scale investment, may well occur alongside the existing standardized machinery of Fordist production. This juxtaposition of old and new technologies may create organizational challenges for management in regards to the coordination of production and the labour process due to the qualitatively different resources demanded by both technologies. Furthermore, due to the newness of flexible technology and therefore unfamiliarity with its use, productivity is often far below expectations when first introduced into the production process. Indeed, production costs may increase in the preliminary stages of implementation (Meurer *et al*, 1987). The successful implementation of flexible technology is therefore far from guaranteed and depends upon the attitudes of both management and labour. As Gertler (1988) notes:

> a major and continuing hurdle is the entrenched roles of management and labour, the former not willing to relinquish the authority on the shop floor which is possessed under the prior organization of work, the latter being reluctant to switch to flexible job descriptions and work rules often demanded by the new physical production systems themselves, but also imposed by management...[As a result]... the outcomes on the shop floor are as much a product of the social/managerial relations surrounding the 'hard' technologies as they are the outcome of the machines themselves (p. 424).

Changes in technology, industrial organization and labour relations do not occur in isolation. A transformation in one domain impacts upon the associated factors of production and is also reflected spatially. It is to these spatial implications that our attention now turns.

Spatial Implications of Flexibility

The transition to more flexible production practices has brought with it implications for the geography of manufacturing, although again there are disputes as to exactly what these implications are. According to Schoenberger (1987), the introduction of flexible technology not only allows the production of new products or production methods but affects labour demand in terms of both quantity and quality. First, flexible automation

decreases the labour costs of a firm by directly decreasing employment numbers. Furthermore, by incorporating machinery with the ability to perform a series of systematized production tasks the need for manual, low skilled labour decreases along with the importance of labour costs as a locational factor in comparison to capital costs (Schoenberger, 1987, p. 205). As a result the Fordist tendency for assembly type production to decentralize to low cost labour areas via the spatial/new international division of labour is reduced. Schoenberger further argues that the need for a core, highly-skilled, functionally flexible workforce increases the relative importance of skilled labour as a locational factor. As Schoenberger (1987) notes, "insofar as capital utilization is tied to the existence of a (spatially bounded) polyvalent workforce, then the cost savings that could be achieved through a more extensive spatial division of labour becomes less compelling" (p. 205). This reduction in the tendency towards a spatial division of labour is compounded by the increasing locational attractiveness of local labour markets containing a high proportion of skilled labour. As Gertler (1988) notes, "given the increased demand for multi-skilled workers to fill those jobs which do remain, firms employing flexible technologies will naturally be reluctant to leave large metropolitan labour areas where such workers are most readily available" (p. 423). The consequence, for Schoenberger, is a shift in locational emphasis from cheap, low skilled labour areas to areas containing highly skilled workers.

In addition, within flexible production systems the ease by which components can be delivered just-in-time for assembly or further manufacturing is greatly increased when suppliers are located within close proximity to the other firm. This not only reduces transportation costs but also minimizes the risk of delays *en route*. In order to ensure smooth production and a high rate of productivity, components must be of consistently high quality. This reliability may be encouraged through the interaction of the manufacturer with its suppliers in order to check quality and the production-supply process. As a result, it is proposed that flexible production systems are characterized by industrial re-

agglomeration, reversing the forces of decentralization under Fordism. As Storper and Scott note, "because of this tendency to externalization of the transactional structures of production, selected sets of producers with especially dense inter-linkages have a tendency to agglomerate locationally...[in order]...to reduce the spatially-dependent costs of external transactions" (Storper and Scott, 1989, p. 24). This statement does more than acknowledge the tendency towards re-agglomeration, it proposes that the rationale behind re-agglomeration is to minimize transaction costs associated with frequent 'just-in-time' deliveries of supplies. While transaction costs based upon the cost of transportation may be an important factor, more qualitative aspects are also significant. Indeed, Phelps (1991) suggests that the transaction costs of information exchange are of greater importance than the exchange of material goods, whilst Lorenz (1992) and Saxenian (1992) emphasizes the importance of community and trust which are best engendered through the industrial agglomeration evident in 'hierarchical' and 'community based' production systems. Consequently, with the emergence of flexible production comes the re-agglomeration of industrial activity. As Scott (1988) notes:

> one extremely important structural consequence of the disintegration of production is a propensity for those establishments that are caught up in transactional relationships with one another to gravitate locationally toward their common centre of gravity...in order to keep the costs of externalized transactional activity as low as possible (p. 42).

As such, due to flexible production practices, the geography of manufacturing may have reached a distinct turning point, a movement away from decentralization and the deindustrialization of the core, replaced instead by "a pattern of 'dispersed concentration' with a number of production complexes located in different regions" (Schoenberger, 1987, p. 210).

Finally, Schoenberger argues that with the introduction of new technology has come the need for a more flexible workforce possessing a variety of skills. Given that Fordist labour relations created high levels of unionization and associated rigidities of work practices, the demands of flexible production may be met more easily in areas removed

from the cores of Fordist production. Therefore, for reasons of efficient worker deployment, production stability and improved labour control, flexible production "could accelerate the shift away from older industrialized areas with a strong tradition of worker militancy" (Schoenberger, 1987, p. 206). Thus industrial development under flexible production may emerge not in the 'Industrialized North East' of the United States or the 'heavy industry' region of Northern England but rather in 'industrial virgin territory' such as Southern California where the social conditions built up in Fordist industrial regions either can be avoided or are not present. As Storper and Scott (1989) point out:

> the geographic margins of industrialization have been pushed outwards, and a series of 'new industrial spaces' have come into being in the various Sunbelts, 'third development zones', and suburban peripheries of the advanced capitalist countries. In all of these production locales, the social and/or geographical distance from the old foci of mass production is great (p. 28).

According to Scott and Storper, industrial development associated with flexibility represents a new form of industrial organization, new labour relations, the introduction of new flexible technologies and the emergence of flexible production systems in new geographical areas. As mentioned previously, the new production systems are based upon the utilization of the social division of labour through networks of predominantly small firms interconnected through complex and constantly changing transactional linkages. "Accordingly, the turn towards flexibility has been marked by a decisive re-agglomeration of production and the resurgence of the phenomenon of the industrial district" (Storper and Scott, 1989, p. 27). However, not all commentators subscribe to this view. For example, Amin and Robbins (1990) argue that the recent focus upon the potential re-emergence of industrial districts does not represent an end to Fordism or signify a fragmentation of mass markets but is a reaction to increased globalization. As Amin and Robbins argue, "the new localism can then, in one sense, be seen as a kind of boosterism, creating a sense of pseudocommunity in compensation for, and in defiance of, the collapse and disintegration of significant and meaningful localities" (1990, p. 29). In an attempt to evaluate their

extent and significance, it is first necessary to identify what is meant by an 'industrial district'

Flexibility and the Industrial District

According to Piore and Sabel (1984) 'flexible specialization' not only represents a new form of production but also a method of regional development based upon local, indigenous growth and an increasing emphasis upon small, interdependent firms operating in a competitive market place. Evidence drawn from the Third Italy supports this suggestion, with wage rates in 1990 twice the national average and per capita income rising from seventeenth among Italy's twenty-one regions in 1973 to second in 1986 (Herman, 1990, cited in Harrison, 1992, p. 472). This increased interest in the importance of small firms, spatially concentrated into an 'industrial district' via a set of complex inter-relations, has focused academic attention back to the work of the English economist Alfred Marshall. Commenting on British regions such as Sheffield and Lancashire at the turn of the century, Marshall noted that specific manufacturing industries, such as textiles, cutlery and shoes, occurred not through large, vertically integrated firms but rather in spatially concentrated industrial districts of small firms. The inter-dependence of these small firms was explained by the existence of 'an industrial atmosphere' bonding the otherwise independent enterprises together. To quote Marshall (1890):

> the advantages of production on a large scale can in general be as well attained by the aggregation of a large number of small masters into one district as by the erection of a few large works...[I]t is possible to divide the process of production into several stages, each of which can be performed with the maximum of economy in a small establishment [and thus yielding a district consisting of] a large number of small establishments for the performance of a particular stage of the process of production (p. 25, quoted in Harrison, 1992, p. 474).

In an attempt to define 'an industrial district' Sforzi (1989) proposes that three conditions must be met. First, there must exist a cluster of small firms specializing in the different stages of the production process, 'a system of interacting parts'. Second, the labour force should be characterized by a high level of small entrepreneurs, artisans and skilled

workers, although not all must be present. Finally, there should be close proximity between home and work. The industrial district is therefore composed of an agglomeration of skilled, specialist workers, interacting with each other through the local market. The dominance of small firms in the industrial district is due in part to vertical disintegration and the focus upon process specialization, (with demand limiting the size of the enterprise). However, this is not to disqualify the presence of a few large firms in such industrial restructuring, for as Scott argues, "largeness as such does not in and of itself disqualify a producer from participating in the social division of labour, the formation of external economies, and agglomeration" (Scott, 1991, p. 7). As is evident in Japan and Germany, many of the largest multinationals have organized production on the lines of flexible specialization, for example Toyota at Toyota City, and Bösch in Baden-Wüttemberg (Cooke and Morgan, 1990), in a process termed 'flexible mass production' (Sabel, 1989, p. 37). However, the ideal-typical industrial district is based upon small, interconnected firms.

These industrial districts have grown up in a variety of geographical locations and display a variety of different forms. Scott and Storper (1992) suggest three different forms of industrial district. The first of these is proposed to have developed around craft based, design-intensive industry. These are generally found in two main areas, either old centers of craft production such as clothing, ceramics, etc. in the Third Italy, or in the inner city of large metropolitan regions, such as the motion picture industry in Los Angeles and clothing in New York. The second form of industrial districts are those based upon high-technology industry, mainly to be found in suburban zones of major cities, such as Silicon Valley, California, and Cambridge in the United Kingdom. The last form of industrial district identified by Scott and Storper are those based upon producer and financial services. These are found in the central core of large cities such as London, New York and Paris. Each of these forms of industrial district are very different from each other, however: "a common underlying system of structural dynamics can be detected in virtually

every case...revolv(ing) for the most part around the social division of labour, the formation of external economies, the dissolution of labour rigidities, and the re-agglomeration of production" (Scott, 1988, p. 181). A fourth form of industrial district, overlooked by Scott and Storper, may be identified as combining the quality of customized production with the high volumes attained through the use of new flexible technologies, for example Toyota (Sayer, 1989) and Mutsushita (Patchell, 1993) in Japan. Each of the above agglomerations may be viewed as a specific type of industrial district, produced as a reflection of the place upon which they are set.

Within an industrial district each firm performs a series of specialized tasks within the complex, and each in turn continually adjusts its internal operations in accordance to the changing demands of the other producers. As such, industrial districts may be characterized by "the extensive division of labour among small firms which require each others' product, cooperation, and proximity, but are also independent" (Amin and Robbins, 1990, p. 23), or a 'factory without walls' in the words of Marshall. Firms within an industrial district are no longer autonomous but rely upon the reproduction of the social division of labour and external economies for their survival.

However, agglomeration alone does not guarantee the reproduction of the industrial district. Firms may be overly competitive and exploit inter-firm relationships for the individual benefit of the firm rather than the community. Hence, the survival of the industrial district not only depends upon the minimization of material transaction costs and competition but also upon the pursuit of high value products and the maintenance of a degree of cooperation. It may be argued that this competitive-cooperation of firms in the industrial district is embedded primarily with feelings of trust and the sense of community between firms, but is also dependent upon the success of regulatory agencies to ensure the reproduction of the 'industrial atmosphere' and local labour markets. Both of these deserve more attention.

Within a social division of labour firms are highly dependent upon the other firms to which they are linked. For the production system to operate efficiently transaction costs should be kept low. The actual or perceived cost of transactions may be increased in various ways, thereby threatening the social division of labour. First, if either firm in a relationship withholds information which may later offer a competitive advantage then information is asymmetrical. Second, and linked to the first point, if there is a low level of trust between firms then the probability of asymmetrical information flows increases, as does the probability of contractors stockpiling supplies just-in-case the subcontractor does not perform as promised. As a result the social division of labour begins to break down and inflexible work practices become apparent. The reproduction of the social division of labour within industrial districts therefore greatly depends upon the level of trust and sense of community between the otherwise independent firms. Lorenz (1992) suggests that the sense of community in an industrial district is increased if the firms hold common beliefs and values, have direct relationships and practice reciprocity. This sense of community and reciprocity correlates to the idea of 'goodwill' proposed by Dore (1987). The key thrust here is that for a firm to enter into long standing business relationships with another firm there must be a sense of trust and benevolence, a sense that there is more to benefit from making information common-knowledge and that "anticipated benefits of future mutual cooperation are valued higher than the one-time rewards of defecting while others cooperate" (Lorenz, 1992, p. 197).

This emphasis upon trust and community highlights the significance of 'place' in a period of flexible production, where local culture, socio-economic climate and local ideology can be an important influence upon the nature of inter-firm linkages. As Hayter and Patchell note in reference to Japanese and British production systems, "it needs to be recognized that these industries are part of distinct 'industrial cultures' representing different sets of beliefs, microeconomic practices and government-business relations...[resulting in]...significant and long standing differences in entrepreneurial

attitudes and policies, especially with respect to innovation" (Hayter and Patchell, 1993, p. 1440). In this regard, it may be suggested that the industrial strategy of western economies has traditionally shied away from the coordination of activity through the market, towards coordination through the hierarchy of a vertically integrated firm. In relation to 'transaction costs' (Williamson, 1979), it would seem that the cost of exchanging information in Anglo and American economies is far higher than in Japan, such that "where there are no significant economies of scale to be gained by their mutual interdependence, one party (usually the stronger one) buys out the other to put a stop to his [or her] 'opportunism'" (Dore, 1987, p. 173). As such, inter-firm linkage has tended to operate via 'spot-contracting' on the basis of price rather than quality, the relationship being more of a one-night-stand than a marriage. In contrast, through a feeling of mutual goodwill and dependence, Japanese firms do not feel threatened by information sharing but see it as a method of benefiting the community, and thus the firm, by promoting linkages between small firms and encouraging a social division of labour. Variations in culture, ideology, religion and the significance of 'place' may therefore be of importance when attempting to understand the diversity of industrial experience over space and over time.

Furthermore, firms may be compelled to comply to community norms due to the threat of collective action from the remaining firms, making cooperation the preferred outcome. The ability to judge the trustworthiness of other firms is of extreme importance in industrial districts due to the informal nature of 'contracts'. Contracts are rarely legalistic documents, often being spoken or 'handshake deals'. As such, trust must be built up over time through relational contracting and informal deal-making, being able to continually adjust to the demands of the related firms, helping out related firms in times of crisis and to meet related firms on a regular basis. As one manager pointed out, "It is important to talk, to know each other. This is a partnership. If we know each other, it is easier to resolve problems and to adjust...[T]he closer we are to each other, the easier it is" (Lorenz, 1988, p. 208, cited in Harrison, 1992, p. 477). Trust is therefore facilitated by personal contact

and contact facilitated by geographical proximity. Firms in industrial districts where there is a strong sense of community often share information on wage rates and the labour market, products produced and problems encountered (Lorenz, 1992). Information sharing and personal contact is also promoted through both formal and informal institutions within the industrial district. For example, Harrison (1992) notes how information sharing between competitive entrepreneurs is promoted through informal means via social clubs, churches and extracurricular activities, and in more formal settings of local co-operatives and regional government agencies.

Institutions within industrial districts also serve as collective agencies. These institutions, generally in the form of industrial associations, serve the industrial district in a variety of ways. First, associations help firms satisfy their labour demands. This may occur through setting up lists of available labourers and tradepersons for management to access when searching for employees. Alternatively associations may help in training workers and introducing new production processes to firms (Scott and Storper, 1992, p. 14). Second, since firms within an industrial district are generally small and therefore individually have little political power (or time to invest in such matters), industry associations may act as a political representative for firms in order to lobby government on issues of relevance. Third, associations may help firms market their product both nationally and internationally through collective advertising, providing marketing advice, and organizing trade exhibitions. Fourth, an industry association may act as a regulator of product quality through the setting of industry standards and through acting as an independent arbitrator in times of dispute between supplier and customer. Lastly, industry associations may promote information exchange by setting up social activities such as dinners, industry seminars and sporting activities.

In her study of the semiconductor industry in Silicon Valley, Saxenian (1992) noted the existence of several industry associations serving the collective needs of small, independent firms. For example, 'The Semiconductor Industry Association' represents

local semiconductor firms in lobbying the U. S. federal government on the issue of foreign competition. 'Semiconductor Equipment and Materials International' organizes trade shows to help market the produce of the local firms and sets industry standards to minimize the risk associated with the externalization of production. Lastly, 'The Software Entrepreneur's Forum' is responsible for the 'networking' of independent firms in order to promote social activity and information sharing.

It may be noted that industrial associations are geographically bounded, that is, they generally represent local or regional firms, most often those firms belonging to a specific industrial district with very distinct objectives and requirements, often including political lobbying. The re-agglomeration of industrial activity may therefore be viewed as a distinct contrast to Fordism. Whereas the vertical disintegration associated with Fordism decentralized production over *space*, the re-agglomeration of production under flexible specialization emphasizes local concerns and local culture, that is, the importance of *place*. As Gertler (1992) notes, "not all industrial districts are created equal...[there is a growing need to study]...how local history, culture, institutions, and industrial structure interact with evolving global competitive forces to produce local development strategies" (Gertler, 1992, p. 273-4). This may in turn impact upon political, social, economic considerations in the future. As Lepietz (1993) suggests:

> from the smallest Italian district to the world metropolis, the new technological paradigm of 'flexible specialization' would give the impulse for return not only of factories and offices to the urban zones, but also to a quantitative growth of metropolises: at last a way out in spatial terms of the Fordist crisis! The future hierarchy of towns and of urban regions world-wide would be the result of the internal strategies of the districts (p. 13).

It may be these explicitly geographical considerations that prove the most significant to our continued understanding of flexible production systems.

Chapter 3

Flexible Specialization and the Remanufacturing Industry of British Columbia

The purpose of this chapter is to describe the structure of the remanufacturing industry in British Columbia and to interpret this structure from the perspective of the concept of flexible specialization. Proponents of the flexible specialization thesis argue that the emergence of a flexible production system has been associated with the vertical disintegration of large corporations into small, relatively autonomous divisions, and the increasing importance of independently owned small and medium sized enterprises (SME's). In contrast to the oligopolistic large corporation, flexibly specialized SME's are believed to operate in a competitive, and yet cooperative, market environment through a social division of labour. As was mentioned in chapter two, associated with a social division of labour is an emphasis upon local inputs, an increased complexity of inter-firm transactions, and the development of just-in-time delivery in an hierarchical or community based production system. The recent increase in emphasis and importance of the remanufacturing industry, along with the restructuring of primary producers in the province, may be a reflection of a move towards a forest industry based upon flexibly specialized small and medium sized competitive enterprises.

This chapter reveals the characteristics of the remanufacturing industry, explores significant changes in these characteristics over time and highlights some of the important issues facing remanufacturers in the province. Information was gathered from secondary sources in the form of private consultancy and government agency reports (federal and provincial) published over the last decade, from industry associations, as well as from academic research. These reports provide useful data on aggregate characteristics and trends. In addition, evidence drawn from case-study interviews of the six surveyed firms

is used to provide detail and insight into the nature of the remanufacturing production system.

The chapter comprises three sections. The first section places the remanufacturing industry in the context of the provincial forest products industry and as a component of the value-added sector, highlighting the increased pressure on the forestry industry to move to a more value-added industrial strategy. The second section, bolstered by case-study evidence, examines aggregate characteristics of the remanufacturing industry, associated changes over time, and discusses some of the pressures operating to cause such changes. The final section assesses the extent to which the remanufacturing industry in British Columbia can be considered to be flexibly specialized. A brief outline of the character of each case-study firm may be of use at this stage. Firms A, B, C and D are non-tenured independent remanufacturers, that is, they do not own cutting rights to provincial forest land and are not affiliated to any large tenured corporations. Within the production system firm A operates relatively independently of other remanufacturers, processing 85% of volume internally. Firm B is a contractor, processing the majority of fibre externally. Firm C is a capacity subcontractor, and firm D is a specialty subcontractor, both remanufacturing lumber on a service basis for contracting firms, (the classification of subcontractors will be explained in detail later in this chapter). Firms E and F are subsidiaries of large corporations established to process remanufactured products. Greater attention is paid to the specific characteristics of each firm within this and the following two chapters.

The Forest Industry in British Columbia

Since the 1930's the forest industry of British Columbia has focused upon the primary manufacture of relatively low-value, commodity products, particularly kraft pulp, newsprint, and dimension lumber largely for the United States construction market. Indeed, it has been suggested that the British Columbian economy illustrates the 'staples trap' syndrome, with its commodity and market specialization. It may be suggested that

the production of commodity products to serve the North American market is largely a reflection of the Fordist production methods dominant in the province in the post-war years. These Fordist techniques have promoted the concentration of capital into large, vertically integrated plants, often owned by foreign interests, thereby removing decision making out of the province. Furthermore, production has largely focused upon mass production technologies operated by a unionized workforce.

As was described in chapter two, this Fordist production system experienced a crisis during the 1980's in the majority of developed nations. The recession severely affected British Columbia. Many sawmills were closed, particularly coastal operations as at least 23,000 forestry workers lost their jobs. Official unemployment levels within British Columbia rose to 14.7%. Many of the forest product plants that were not closed down permanently underwent in-situ restructuring aimed at increasing efficiency, diversifying the markets served, promoting industrial flexibility, and producing products of higher-value than the commodities manufactured in previous decades.

The Shift to Value-Added Production

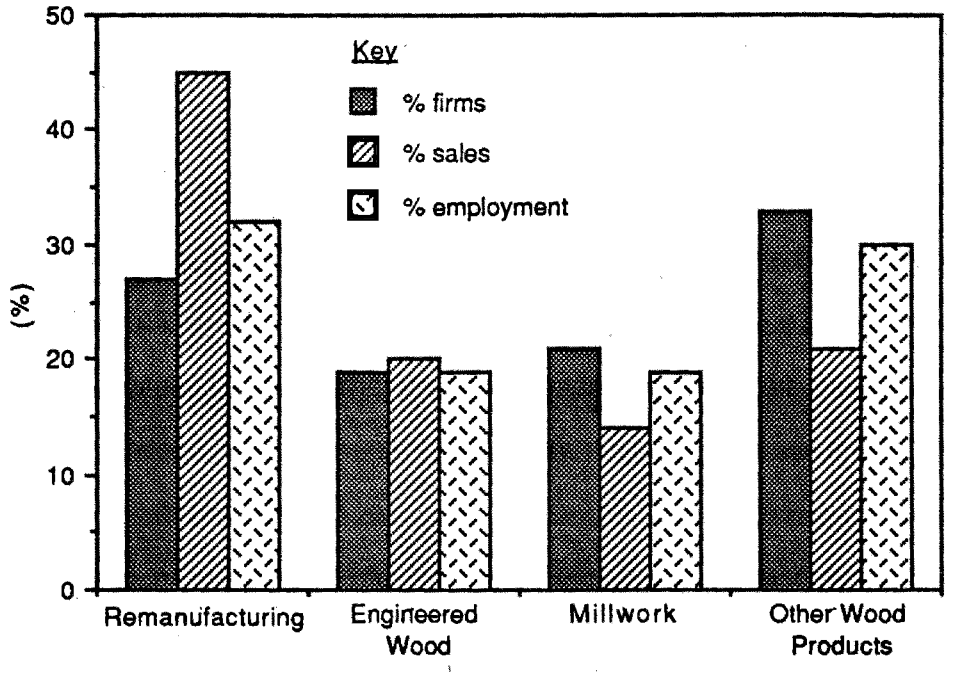
Simply defined, value-added is the value of the manufactured product less the cost of the materials, supplies and energy expended during production. In the case of British Columbia, value-added occurs when dimension lumber is manufactured from a log in a sawmill, or when pulp is converted to newsprint in a papermill (see Figure 1.1). However, many commentators argue that, until recently at least, the value-added process was essentially limited to primary manufacturing. Paper has not diversified much beyond the production of newsprint, and pulp production has primarily served export markets rather than secondary manufacturing within the province. Lumber has not been manufactured into furniture for example, and firms have remained specialized upon serving the North American market. The crisis of the 1980's served to highlight the susceptibility of this industrial strategy to changes in market demand and increased international

competition. In reaction against product and market specialization, and in an attempt to take advantage of the new opportunities presented by growing international markets, the promotion of the secondary, or 'value-added', wood products sector has been viewed by the provincial government as a vehicle to increase the flexibility and consequently the vitality of the forest products industry.

The term 'value-added' can be used to describe any activity which increases the value of the manufactured product. As such, we may speak of a 'value-added drive' within British Columbia to increase the financial worth of the resource base, where primary as well as secondary manufacturers may actively add value to the forest resource. In practice, the provincial government perceives the 'value-added' wood product sector in British Columbia as comprising "secondary wood product manufacturers that add value to commodity wood or wood-based material by further processing it into specialty finished or semi-finished products" (McWilliams and Forintek Canada Corp., 1991, p. 1). As such, value-added manufacturers have been grouped according to their product lines (McWilliams and Forintek Canada Corp., 1991, 1993; Price Waterhouse, 1992). In these reports, which focused solely on the wood products sector, value-added manufacturing was divided into four main categories: remanufacturing; engineered building components; millwork; and other wood products.

In 1992 there were 565 firms in the value-added wood products sector (or secondary manufacturing wood industry), composed of the four main categories specified above (Price Waterhouse, 1992). Remanufacturing is the largest industry of the value-added sector and comprised 27% of firms and 45% of annual sales in 1992 (see Figure 3.1). Remanufacturing may be defined as producing "specialty products from commodity lumber and panel products...and includes manufacturers of lumber specialty products, fencing, specialty panelboard, and custom processing activities such as lumber drying. It also includes finishing departments of primary sawmills that make specialty products" (Price Waterhouse, 1992, p.2).

Figure 3.1 The Value-added industry by percentage of establishments and sales, 1992



Source: Price Waterhouse, 1992

The engineered building components industry comprised 19% of firms in the value added sector in 1992, employing 2,100 full-time workers, with 20% of the sales in the value-added sector. This industry "contains a diverse group of companies, including manufacturers of laminated beams, trusses, prefabricated buildings, log homes, and wood treating plants" (Price Waterhouse, 1992, p. 8). The millwork industry includes manufacturers of wood doors and windows, architectural woodwork and turned wood for stair spindles. This industry employed 2,000 full-time workers in 1992, and comprised 21% of value-added firms. The 'other wood products industry' is an amalgam of small wood product industries including cabinet and furniture manufacturers, pallet and container firms, and miscellaneous wood products such as chopsticks. In total, these other wood product industries employed an average of 3,200 employees, comprising 21% of sales and 33% of establishments. From this information it is evident that the remanufacturing

industry is the most significant industry in the value added sector and comprises firms with more employees and larger sales volumes on average than the other three industries.

In 1992, the value-added sector provided an average of 11,000 full-time jobs, constituting 12% of total employment in the British Columbia forest product industry. However, employment in the value-added sector does vary due to the use of temporary workers to deal with fluctuations in demand and seasonality, with August and December being slow months due to holidays. Financially, the value-added sector produced $1.3 billion in revenue in 1992, constituting 12% of total provincial forest industry revenue (Price Waterhouse, 1992).

In contrast to the large firms which dominate primary manufacturing in the forest products sector, the average size of firms in remanufacturing is small, employing an average twenty full-time workers per firm. There are, however, large firms involved in secondary manufacturing. Thus, corporate giants such as MacMillan Bloedel and Canadian Forest Products have both established operations which remanufacture lumber and manufacture a variety of components. The remanufacturing operations of these firms are therefore included within this section. As mentioned above, remanufacturing is the largest industry of the value-added sector. It not only utilizes the most employees, contains the highest number of firms and has the largest sales volume, but also consumes the greatest amount of wood and has the highest revenue per plant. So what are the characteristics of the remanufacturing industry?

The Remanufacturing Industry

Through reprocessing wood from commodity lumber into specialty items, the remanufacturing industry acts as an interface between primary manufacturers and manufacturers of finished wood products. In this way the remanufacturing industry adds value to the resource base. For example, as early as 1984 (when the promotion of remanufacturing in British Columbia was in its infancy), it was estimated that $70 million

was added to wood products by remanufacturers (Woodbridge, Reed and Associates, 1984, p. 8).

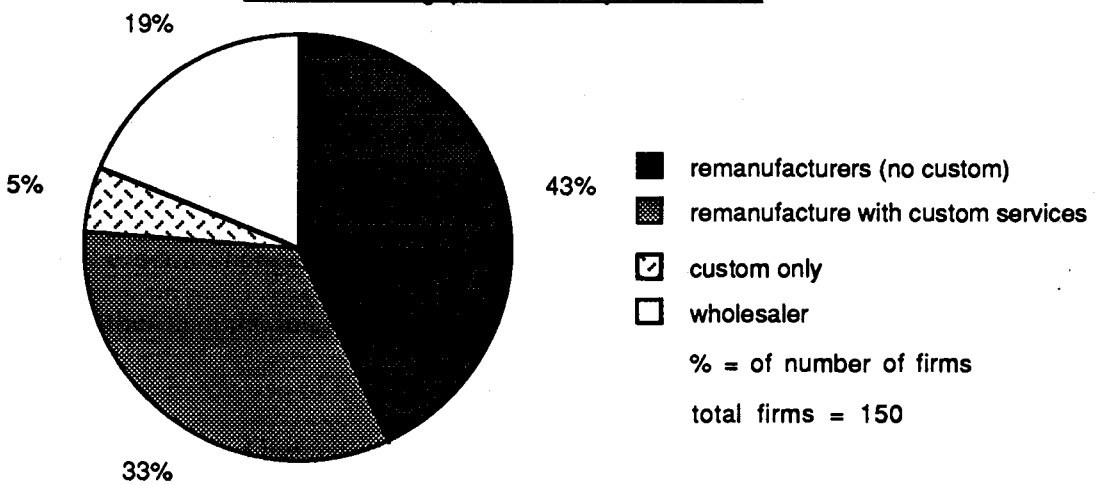
Through the use of secondary data and case-study interviews, this section reveals the characteristics of the remanufacturing industry, discusses the nature of the remanufacturing production industry as an example of 'flexible specialization' (Storper and Scott, 1989), and highlights some of the changes that have occurred throughout the industry over the last decade.

Industrial Organization -

Perhaps the most striking characteristic of remanufacturing firms in comparison to primary manufacturers is their size. The average number of full-time employees in remanufacturing firms in British Columbia is 23 people and has remained in the mid-twenties over the last ten years. The remanufacturing industry now employs approximately 3,500 full-time workers annually, in comparison to 1,800 in 1984, with the majority of this employment increase resulting from new firm formation rather than existing firm growth (McWilliams and Forintek Canada Corp., 1993). None of the five independent remanufacturers interviewed employed more than 60 full-time employees, with an average of 32 full time employees in each firm. However, the number of workers employed by the case-study remanufacturing firms varies over time in two ways. First, fibre supply from the large sawmills is unreliable and inconsistent, producing peaks and troughs in production. Second, demand fluctuates, with the Christmas period and the month of August being slower months, where as April to July is reported to be the busiest time of the year. In order to cope with these fluctuations, three of the five independent remanufacturers interviewed utilized temporary employees, thereby increasing the employment levels. However, even with these more transient part-time and temporary workers included, no firm employed more than 100 workers at the same time.

The small size of the remanufacturing firms may be significant to the success of the industry. Remanufacturing firms do not perform the same tasks or produce the same products. Rather, through a social division of labour, each firm specializes in a handful of processes, whilst remaining flexible enough to react quickly when market demands change. Within this production system the remanufacturing industry may be divided into three main elements; the specialty lumber remanufacturer (comprising the 'independent' remanufacturer and the 'contractor'), the custom remanufacturer (comprising the 'capacity subcontractor' and the 'specialty subcontractor'), and the specialty product sawmill.

Figure 3.2 - Industrial organization of the British Columbia remanufacturing production system, 1989.



Source: Industry, Science and Technology Canada, 1989

The specialty lumber remanufacturer generally buys wood from local sawmills, thereby owning the wood that is processed. The wood is then remanufactured into specialty items of varying specifications depending upon the requirements of customers, to whom the product is then sold (which often means a distributor or wholesaler). Many of these firms contract out certain processes to subcontractors within the local production system. Consequently, there exists two extreme cases of specialty lumber remanufacturers. First,

the 'independent' remanufacturer processes all their wood in-house, rarely contracting out processes and performing no subcontracting services to other firms. Second, the 'contractor' externalizes many of the production processes by contracting them out to local subcontractors. As shown in Figure 3.2, 43% of remanufacturers in British Columbia are specialty lumber remanufacturers, comprising both 'independent' remanufacturers and 'contractors'. Although such a typology represents two extremes, in-depth investigation reveals case-study Firm A as an 'independent' specialty lumber remanufacturer, performing 85% of processes in-house, with Firm B classified as a 'contractor', with between 50-60% of processes contracted out to local subcontractors.

The custom remanufacturer, or subcontractor, provides other remanufacturing firms (including the specialty lumber remanufacturers), sawmills or distributors with the service of remanufacturing lumber. Many subcontractors also purchase fibre privately in order to increase production efficiency and to achieve a certain degree of production autonomy. However, these subcontractors depend largely upon work contracted out from other local firms in order to survive. In British Columbia 33% of remanufacturers supplement production by performing custom services to contractors, this figure rising to 46% within the Lower Mainland, (see Figure 3.2). A further 5% of remanufacturers in British Columbia are custom only firms, relying upon work from contractors. The interviews revealed two different types of subcontractor, 'capacity' and 'specialty' subcontractors.

The capacity subcontractor is contracted out by remanufacturing firms to perform processes which could be performed in-house but are more cost effective or efficient to perform externally. These processes tend to involve either large volumes, such as the initial breakdown of lumber into grades and dimensions which distract from the specialized processes performed by the contracting firm, or the performance of low volume or speciality tasks that the contracting firm finds inefficient to perform. Firm C represents a capacity subcontractor, performing initial breakdown processes.

The second form of custom remanufacturer is the specialty subcontractor, performing specialized processes that the contracting firm does not have the technological capability or qualified labour to perform. In the remanufacturing industry such processes tend to be at the high value end of production and require investment in process specific machinery. Such tasks include laminating, moulding and kiln drying. The manager of Firm B, in talking about a major specialty subcontractor, stated that the firm used "is the only firm in the Lower Mainland and maybe in the Pacific Northwest that can do the small sizes in the way we want. They are strictly a custom plant and they have found the niche which is producing these items for people like us". In the case-study evidence, Firm D represents a specialty subcontractor.

Finally, some primary wood producers in British Columbia have undergone forward integration in order to add value to the product. These specialty product sawmills often have the greatest opportunity to further process wood due to their access to timber. However, as noted, many traditional sawmills are characterized by rigid technology and labour practices which limits the ease with which secondary manufacturing may occur. As such, many large primary manufacturing firms have chosen to make fibre available for lumber specialty remanufacturers to purchase, or use independently owned custom plants to add value to their products. For example, a large Canadian multi-national forest product company rents production space from a custom remanufacturer in the Lower Mainland to serve the Japanese market. Indeed, even in 1984, prior to the intensified industrial and political pressure towards value-added, Woodbridge, Reed and Associates (1984) noted "that well over 50% of [custom remanufacturers] activities are now on behalf of the sawmills" (p. 8). However, with the industrial restructuring which occurred in the last decade, primary forest product companies have established specialty product divisions to remanufacture lumber into value-added products. These divisions may be expected to be somewhat different from the non-tenured remanufacturers since the large firms have a reliable supply of fibre around which to strategically plan, have research and development

facilities, and have previously exemplified Fordist production methods utilizing task-dedicated machinery and a highly unionized workforce. The specialty product division of two large primary wood producers are studied in chapter five (cases E and F).

The remanufacturing industry of British Columbia and the Lower Mainland therefore comprises many different types of firms, each firm performing a specific role in the production system (with the possible exception of the vertically integrated specialty products division of a large corporation). The small size of remanufacturing firms in the Lower Mainland, which limits the extent of economies of scale attainable in production, provides the industry with strength through "substantially greater production flexibility, together with a more entrepreneurial approach and a lower overhead/labour cost structure" (Woodbridge and Reed Associates, 1984, p. ii). Thus, through vertical disintegration and the utilization of a social division of labour, external economies of scale are employed to produce an efficient and yet flexible production system.

Remanufacturers produce up to 100 different products, often to the specific requirements of the consumer. In order to achieve economies of scope in their product mix, remanufacturers utilize a social division of labour, externalizing certain processes through the use of subcontractors. In this social division of labour a remanufacturing firm may produce a wide variety of products requiring many different processes. However, it is unlikely that all processes occur in-house. Rather, remanufacturing firms specialize in performing a limited number of tasks, contracting out the remaining tasks to subcontractors. As the manager of Firm D pointed out, "we are doing things for other people because we can do it a little better, none of us are cookie cutters, everybody does their little aspect of the wood pile somewhat differently". Firm B, discussing the use of subcontractors notes, "certain plants are better at doing certain things than others, so we hone in on the ones that we are satisfied with what they do with a particular item. Just because they are good at this doesn't mean they are going to be good at that". Thus, in the production of a high value product the lumber may pass from the sawmill to a specialty

lumber remanufacturer who sorts it: this wood may then be passed to a capacity subcontractor who cuts it into certain dimensions, and then on to a specialty subcontractor to be kiln dried and moulded, after which it could return to the original contractor, for example as a window blank, for packaging and distribution to the customer.

Product Mix -

The main products produced by the remanufacturing firms interviewed included window and door components, interior and exterior panelling, decking and lumber of various dimensions for further manufacture by the customer. Four of the five firms interviewed stated they served a niche market and produced a wide variety of products for the specific requirements of the customer, with production often including a specialized product being manufactured for the first time. As the manager of Firm A notes:

> A lot of our production is focused upon producing something that is one of a kind for the customer. Maybe 10% of our finished product will be in that category, where we are doing something quite unique. If a guy is making picture frames we can produce [the components] in a specified size. We are doing a sophisticated window part for somebody at the moment, it is really one of a kind, it is only for him. Products that are totally unique to that customer.

The production of a variety of specialty, niche products to the exact requirements of the individual customer limits the utility of economies of scale associated with the production of standardized 'widgets'. As such, production by remanufacturers often occurs in small batches, utilizing economies of scope. As the manager of Firm D relates, "We produce 70 to 100 different products...In terms of pieces we are doing red cedar orders down to less than one hundred pieces, which might take twenty minutes to run, right up to million feet orders that take two or three days." The production of niche products to the specifications of the consumer is made possible, in part, by the external economies of scale that exist within a social division of labour, where each firm specializes in a narrow range of processes, the culmination of inter-firm transactions eventually creating a finished product.

Despite the ability for remanufacturers to produce a wide variety of products for

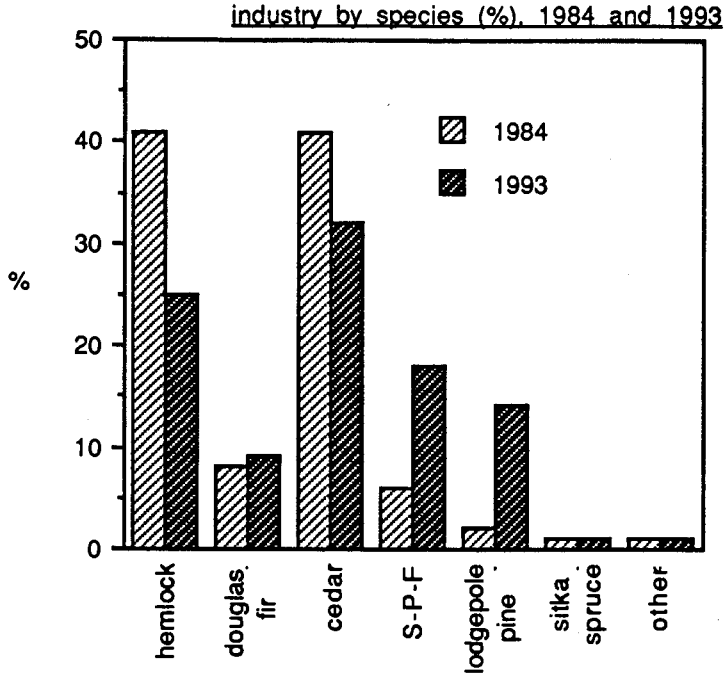
consumer demand, interviews and reports emphasize the necessity for product flexibility in order to compensate for the unreliability and inconsistency of fibre supply.

Fibre Supply -

Remanufacturing in British Columbia is concentrated in a handful of forest districts, the largest of these located in the Lower Mainland (see Map 3.1). In 1993, 40% of remanufacturers in British Columbia were located in the Lower Mainland; the balance found mainly in Kamloops, Prince George and Nelson. Each centre has distinctive characteristics, including accessibility to different wood species. Whereas the dominant species exploited on the coast are western red cedar and western hemlock, interior remanufacturers utilize local supplies of white spruce, lodgepole pine and alpine fir (S-P-F). The species used by remanufacturers in British Columbia have also changed over time due to the depletion and inconsistencies of fibre supply, caused in part by environmental pressures, aboriginal land claims and an increased reliance upon secondary growth timber. As such, the main changes have occurred along the coast where these issues are most prevalent rather than the interior, and in the coastal region over the last ten years there has been a decrease in the use of hemlock and cedar, in conjunction with the increased use of S-P-F, Douglas Fir and lodgepole pine (see figure 3.3).

By far the greatest issue facing the remanufacturers is lack of available fibre. Reductions in the annual allowable cut have increased the competition for fibre, especially for the 'shop and better' grades that remanufacturers prefer. This competition has been compounded by increased interest on the part of major corporations in adding-value to their wood base through secondary manufacturing. This increased competition for fibre has had the greatest impact upon the availability of red cedar, at one time far and away the dominant species. Indeed, its reduced availability, despite decreasing quality and consistency, has led to increased cost per thousand board feet (see figure 3.4). Consequently remanufacturers have been faced with increasing uncertainty in regards to material inputs.

Figure 3.3 - Fibre used in British Columbia remanufacturing industry by species (%), 1984 and 1993



Source: Industry Reports, 1984 and 1993

As the manager of Firm A noted:

> It is changing all the time. I think recently the fibre that we have been getting for the most part is deteriorating as far as grade is concerned. As a remanufacturer, it doesn't really matter what grade you get from a mill as long as it is the same every time because then you know what you are getting. What you don't want is what we are seeing right now and that is the peaks and dives in the grades, you just don't know where you are with things like that. Generally the wood supply is very unstable.

Since certain products require specific grades and qualities of fibre, this inconsistency in fibre quality and supply has encouraged remanufacturing firms to broaden their product mix such that variations in fibre character may be accommodated through various products. Such a trend has been reflected in the nature of investment, as the major reasons cited for purchasing machinery are to increase the product mix and to increase the capacity to extract the most quality from the available fibre (a point to which I shall return later).

As would be expected in a resource based industry, remanufacturers received fibre from local suppliers, predominantly from the major sawmill companies of the Lower

Map 3.1 - The Distribution of Remanufacturing Firms in British Columbia, 1989

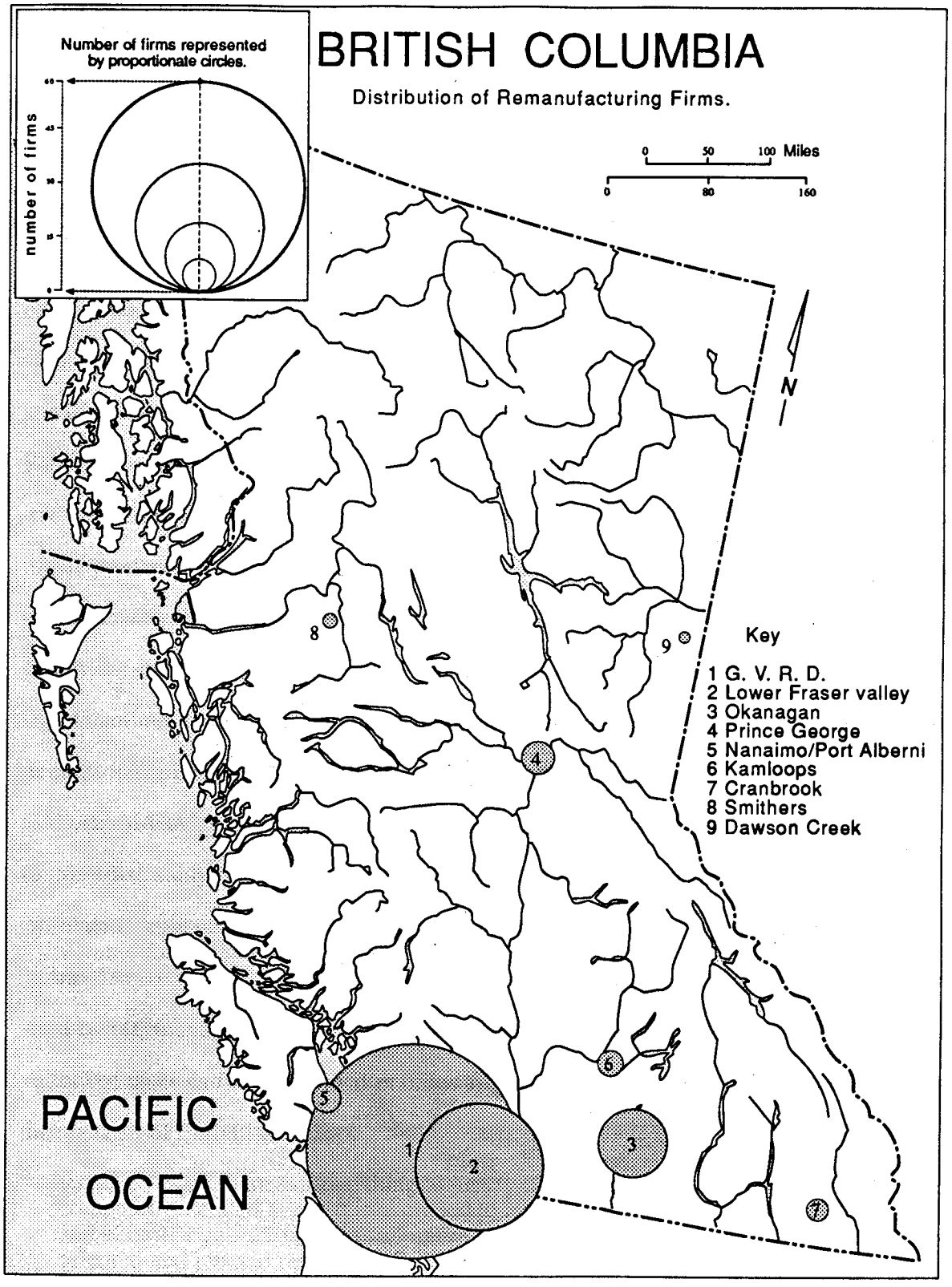
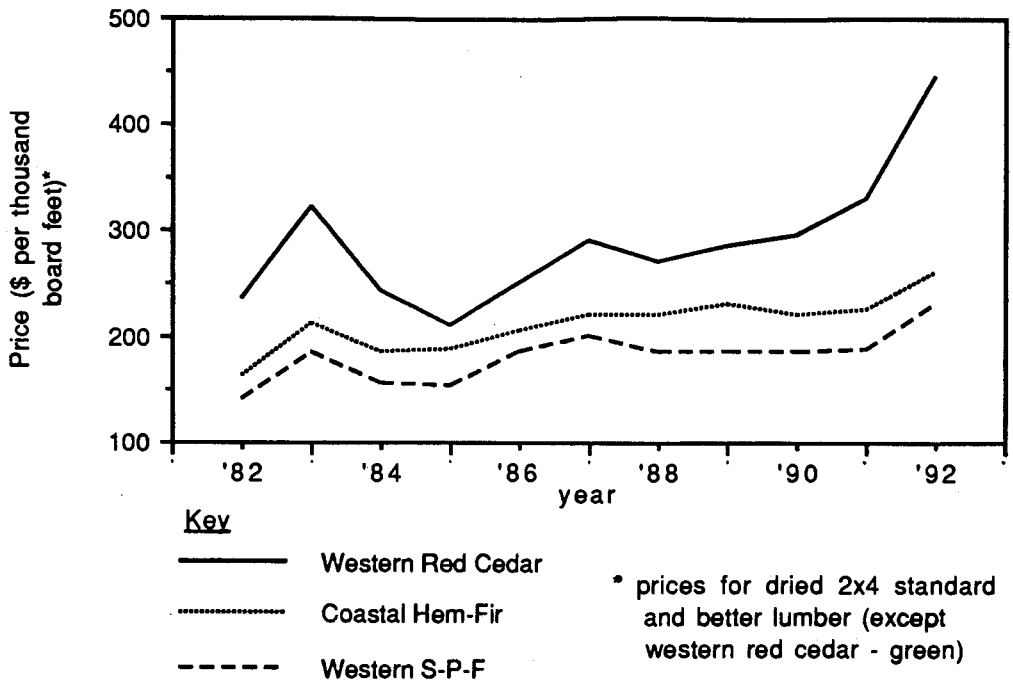


Figure 3.4 - Lumber prices by species, year average 1982-92



Source: Random Lengths Yearbook, 1992

Mainland, and to a lesser degree from Vancouver Island and the interior. All firms received at least 95% of their fibre from British Columbia. Four of the five firms were supplied with at least three quarters of their fibre from the Lower mainland, the other firm (working heavily with S-P-F) purchasing 60% of supplies from the interior. The volume of wood consumed varies from firm to firm, with the largest surveyed non-tenured remanufacturer processing 50 million board feet a year, to the smallest firm processing 9 million board feet a year. The main species used in 1991 were cedar, hemlock and S-P-F, although there was a marked decrease in the importance of coastal cedar and an increase over time in the use of S-P-F from the interior.

Inter-firm Transactions -

Evidence suggests that remanufacturing firms choose to purchase supplies opportunistically, for example when fibre is available at low cost such as at the end of the business cycle, rather than risk becoming locked into a supply agreement where the fibre quality and grade is often inappropriate for remanufacturing the required products. As such, remanufacturers often work on short order files of three to six weeks, purchasing fibre opportunistically and manufacturing a variety of products compatible with fibre characteristics and customer demand. As the manager of Firm B told me,

> We don't buy quarterly, we are opportunistic and we buy accordingly. We are not making a product that we have to have every day of the week and every month of the year. So it is a little different to someone who is making a widget all day long and needs to keep on feeding raw material into the machine, we just don't participate in that. It is very rare for us to buy on quarterly allocations. It is too hard to predict the future, it is hard to sell the product that you may get out of that wood, there are all kinds of uncertainties. We operate on what we have on our plate in terms of a two or three week order file.

This opportunistic nature of remanufacturers is also reflected in the transfer of materials from contractor to subcontractor. Contractors generally build up knowledge of existing subcontracting firms over time through business and social contacts. When custom work is required, the contracting firm contacts those subcontractors with a good reputation for performing the required process and then 'shops around' between those few in regards to price and availability of process time. Rarely does this process involve the signing of a formal contract, the agreement often occurring over the telephone or through an informal handshake deal often based upon reputation, trust and 'gut feeling'. As the manager of Firm B admitted:

> It is a lot to do with personalities, you have to like the person you talk to on the phone, it is all done on the telephone and your word is your bond in this business. The paper work most of the time flows after the fact but sometimes you don't issue purchase orders at all, our legal people can't believe it.

Furthermore, these agreements rarely involve a continual supply of business, generally lasting no longer than the length of the single inquiry. Over time a relationship is built up between the contractor and subcontractor resulting in the use of a core number of firms and

the increased stability of supply. For example, in discussing business agreements the manager of Firm C noted:

> You are not sure when you are going to get deliveries but I would say that although I have got 5 or 6 other accounts this one firm accounts for 50% of my monthly production. It is not an ongoing deal, they don't give you anything in writing as to what volume they will give you per month, we just have a verbal agreement. If the market is good then you have got no problems, if the market is poor then you have a tough time.

The short order file of remanufacturers is not only a reflection of the inconsistency and instability of fibre but also of the niche and constantly changing market served by remanufacturers where customer demands evolve over time, requiring remanufacturing firms to adapt by being flexible in their production system. This market dynamism is reflected at the distribution end of the business where the level of inventory has decreased due to market uncertainty. As the manager of firm B stated:

> the whole method of distribution is changing so much, we used to ship railroads of things and people used to keep a lot of inventory...The pipelines have got a little thinner so there is more constant flow from the manufacturing regions to the distributor levels, which is good and bad. It hurts us to a degree because a lot of the distributors used to keep let us say traditionally 20,000 feet of a certain product line, they may only be keeping 2,000 to 3,000 of each thing now and relying on us to ship it a lot quicker, and have it on our ground rather than their ground.

Fibre is purchased opportunistically depending upon quality and price, and finished products are stored within the system due to unpredictable final demand. Thus, there is little evidence of a just-in-time system where inter-firm transactions are stable, rather inter-firm linkages reflect the instability and uncertainty of local supplies and market demand.

Overall the industrial organization of the remanufacturing production system combines the specialization of individual firms with the flexibility gained through the use of local subcontractors via a social division of labour. However, according to industry managers, the flexibility attained within the social division of labour must be accompanied by flexibility within each individual firm through the use of flexible technology and flexible methods of labour deployment.

Technology -

Since the majority of remanufacturing firms are small, investment in fixed capital is limited to a certain extent by the availability of finance capital. Consequently, the technology utilized by remanufacturers in British Columbia is relatively unsophisticated. However, beyond this limitation there seems to be a reluctance on the part of management to invest in new, high-tech equipment for production. The majority of firms use basic machinery, with different combinations of machines used to produce a variety of different products, relying more upon product innovation and market knowledge than on up-to-date equipment. As Nielson points out, "new equipment won't help the remanufacturer; the equipment is basic and off the shelf. Success in remanufacturing depends on product and market knowledge; how to make a saleable item out of a less desirable one" (Nielson, 1986, p. 10). Thus, of the five independently owned remanufacturing firms interviewed, only one had computers in their production line (a computerized cut-up line) and two companies had no computers in the firm at all. Machinery in remanufacturing is often old and second-hand, too slow for the high productivity required by sawmills but suitable for the short production runs involved with the high value products. The most common machinery utilized by the remanufacturing plants interviewed were (in order of increasing sophistication), green chains, re-saws, trim-saws and rip-saws, planers, moulders, finger-jointers, dry-kilns and laminating machines. In comparison to sawmill machinery currently used in British Columbia this machinery is unsophisticated and slow. The following reasons account for this reluctance to embrace computer technology.

First, investment in sophisticated equipment is limited by fibre supply and consumer demand. Few independent remanufacturing firms hold 'tenure' (forest cutting rights) and thus rely upon primary mills as the main source of fibre. Since the secondary wood products industry has traditionally been a comparatively small market for primary producers it has not been worthwhile slowing down production in order to extract wood suitable for secondary manufacturers. For example, Woodbridge, Reed and Associates

(1984), estimate that 80% of sawmill lumber is cut to construction specifications and thus sawmills "are only able to offer mixed species and sizes, grades and drying tolerances which are unsuitable for the intended secondary manufactured items" (p. 14). Furthermore, since there is a limit to available fibre supply, primary producers have viewed secondary manufacturers as competitors. As Holm (1992) states, "this is the only industry in the world where they (primary producers) view their customers as adversaries and competitors...where in the world does a manufacturer abuse and misuse a customer?" Consequently, the quantity and quality of lumber supplied is unreliable, varying by grade and dimension, and necessitating different production process for different end products. Economies of scale through long production runs of the same product are therefore difficult to attain. Many remanufacturers therefore view the incorporation of computer technology in one production process as inappropriate as production runs are too short to reap a return on the investment and the product designs are continually changing. As Woodbridge, Reed and Associates (1988) note, "computer decision making equipment...has yet to make significant inroads into North American remanufacturing. Indeed it is not yet certain what degree of sophistication in terms of computerization, scanning, robotics, automation, CAD/CAM/CIM, etc. is appropriate, either for the individual company or for the province" (p. 5). Case-study interviews support this view. As the manager from Firm A stressed:

> machinery is part of the flexibility that we have. This company doesn't deal with volume for one minute of it's life. We are product oriented, what does the end user need?

As a result, managers invest in basic, multi-purpose, flexible machinery with which a variety of tasks can be performed in order to produce a number of different products. As the manager of Firm D states:

> you need big volumes of one thing to justify the investment that it takes to make a computer generated line that is restricted to making maybe five products really well and after that you start making compromises. So because our business is customer oriented and job and order specific we have never found the need to have some of the computer programs that are available.

This finding confirms the suggestion by Kelley and Brooks (1988) that sophisticated technologies such as CAD/CAM systems are less appropriate for small firms servicing niche markets than for large firms producing relatively standardized products. Where production occurs, in-house remanufacturers are able to vary their product mix by altering the set-up of available machinery. As the same manager notes, "we are constantly changing all the time. We have five different machine centres and their capacity to do different products is different. Ten products work best on this machine, another 15 are directed towards another machine. We are having to reset machines all the time to be able to produce different products, it is very intricate". Consequently, investment by remanufacturers favours unsophisticated, general purpose machinery over sophisticated, high-technology computer machinery. This low-tech machinery offers firms the flexibility to produce a variety of products by varying machine set-up and organization in order to overcome fibre inconsistencies and market dynamism.

Second, within the social division of labour not every remanufacturer performs the same process. Certain remanufacturers specialize in resawing and trimming lumber, other firms specialize in planing and moulding, whilst others specialize in kiln drying. Although each remanufacturer generally has the ability to undertake each stage of production, individual firms rarely invest in machinery for each process. Rather, firms choose to invest in specific processes and contract out those tasks which they are incapable, or more likely, less efficient at performing. Upon studying the remanufacturing industry Nielson (1986) noted the continual movement of products from one firm to the next for various stages of production. As such, the machinery utilized in-house by a remanufacturer is best understood within the context of the social division of labour as a whole. Where a remanufacturing firm chooses to contract out a large proportion of processing to subcontractors the investment into machinery may be expected to be minimal, with initial breakdown and sorting requiring only basic machinery. By contrast, where a remanufacturer serves as a subcontractor, it may be expected that investment in machinery

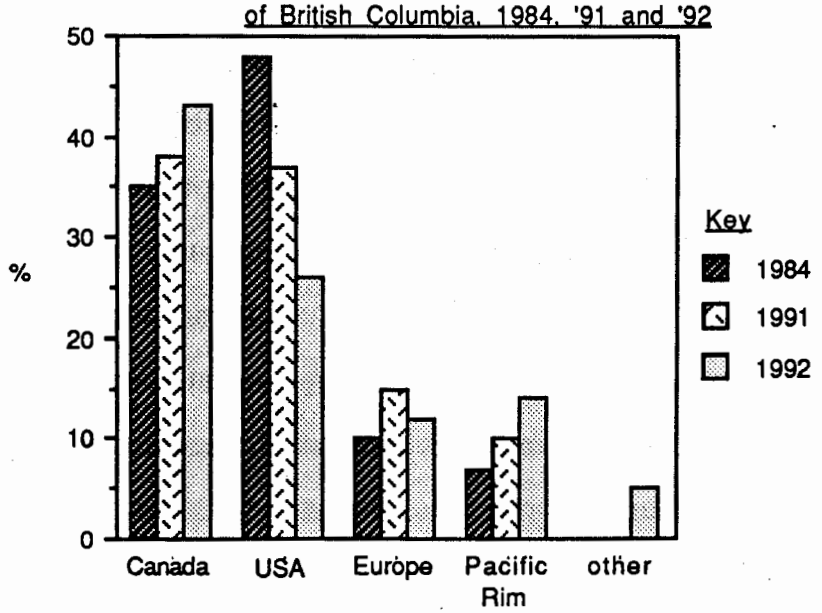
would reflect the service offered, specialty subcontractors investing in more specialized, relatively sophisticated machinery in comparison to capacity subcontractors.

Thus through investments in specific forms of machinery firms achieve product flexibility whilst maintaining individual, specialized niches in the market.

Markets -

Forest products in British Columbia have traditionally focused upon foreign demand, principally serving the United States market with commodity products. Individual plants often export 50-80% of production south of the border (Hayter and Barnes, 1990). In contrast, the remanufacturing industry of British Columbia is significantly less dependent upon U. S. consumption, with this independence becoming accentuated over time. Figure 3.5 shows the markets served by the B. C. remanufacturing industry over the last decade. In 1984 the U. S. accounted for 48% of aggregate provincial exports of remanufactured goods. By 1992 exports had fallen to 26%.

Figure 3.5 The markets of the remanufacturing sector of British Columbia, 1984, '91 and '92



Source: Industry Reports

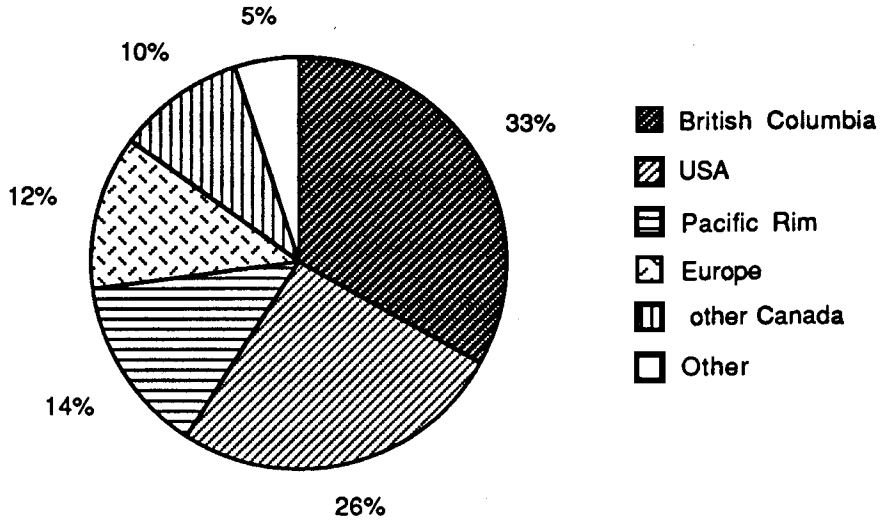
In interviews three factors were cited as causing the overall decline in shipments to the United States. First, remanufacturers in B. C. sold less product south of the border due to the economic troubles experienced in the recent recession, with remanufacturers becoming increasingly cautious about "having all our eggs in one basket". Second, cedar, the most popular species in the United States market, became less attractive to remanufacturers. A decline in the quality and consistency of cedar, accompanied by an increase in price, has reduced the profit margin received by remanufacturers, making other species and markets more attractive. Third, the introduction of export tariffs upon high-value Canadian wood products diminished diverted sales to other countries. As the manager of Firm A stated:

> Last year when the tariff reared it's ugly head in the States again, you don't sit down and make a huge policy change but in a de facto way you start de-emphasizing one product or one country and doing other things. We consciously do less in the States now, we are more into Europe, more into the Orient, more into the local market.

Through interviews it was found that four of the five non-tenured remanufacturers use wholesalers to serve the United States market, whereas European markets are serviced directly from the remanufacturer to the customer. This use of wholesalers may be an effort to externalize the uncertainty involved in supplying the United States, and also to act as a reputable, and yet relatively cheap, outlet for the specific firm. For example, Firm D stated, "we are a small firm and so we can't afford an in-house distribution department so we use a wholesaler to sell our products, to build up the image of our firm; they are used almost on a contract basis". As Figure 3.6 shows, although two thirds of remanufactured goods are sold within North America, local producers now service a variety of markets, limiting fluctuations in demand associated with an over-dependence upon U. S. demand.

Alongside the relative decrease in United States sales has been the rise of Pacific Rim markets, particularly Japan. For example, Japanese demand has been reflected in the sawmill industry where production modernization has focused upon supplying lumber of various sizes and high 'clear' quality. In addition, the supply of remanufactured products

Figure 3.6 - Markets of the Remanufacturing Sector of British Columbia, 1992



Source: Price Waterhouse, 1992

from British Columbia to Japan has increased from 7% of remanufacturing provincial sales in 1984 to 14% in 1992. The restructuring of the primary manufacturing industry, combined with the increased importance of remanufactured products for Japanese markets signifies a rise in the value of exports from British Columbia. The increase in Japanese demand may have been caused by the increased strength of the Japanese yen (making it more favourable to import finished products rather than semi-processed goods), the near exhaustion of available domestic forest resources, and labour supply problems. The capability of the remanufacturing industry to manufacture products of high value and quality to specific consumer tastes may prove beneficial as Japanese demand grows, providing the small firms can forge a strong relationship with Japanese buyers and avoid extended distribution chains so as to ensure they continue to serve the specific niche demands of their distant customers. Currently, remanufacturers seem reliant upon distributors to service the Japanese market, such as the use of Japanese trading houses to supply the small manufacturing firms. As the manager of Firm D notes:

> we don't tend to sell directly into Japan, we tend to sell to the trading houses. There are a lot of small mom and pop shops and they will want one or two bits of lumber for their particular product at that time. It is pretty hard to access that type of business from over here so we have selected people who would get us as close to them with a minimal amount of double handling.

Furthermore, with low labour costs relative to Japan, Taiwan has emerged as a market for semi-finished goods for remanufacturers, acting as a 'stepping-stone' to the Japanese market-place.

Along with Pacific Rim demand, the European market remains relatively stable at around 10% of sales throughout the province. However, for the five non-tenured remanufacturers the importance of the European market varied widely. For Firms C and D (the subcontractors) sales to Europe were negligible, whilst for the other three firms European demand fluctuated at around 25%. Thus, interviews with individual firms indicated a move away from cedar products for the United States market, towards the increased use of hemlock and S-P-F for the Japanese and European markets due to market instability and the changing global economy.

Furthermore, the Canadian market has increased significantly from 35% in 1984 to 43% in 1992, with one third of all sales in 1992 staying within the province. Perhaps this is a reflection of the need to have closer ties with the customer in order to best respond to consumer demands. The majority of products produced for the local market are distributed by the remanufacturer directly to the customer, most often a manufacturer or another remanufacturer. In contrast, the use of wholesalers and distributors by remanufacturers in the Lower Mainland as their method of reducing the costs and uncertainties of servicing distant markets.

Labour Relations -

Labour relations in the remanufacturing industry are distinct from much of the traditional primary wood products industry. Only 29% of British Columbia's remanufacturing firms are unionized. This is in part a reflection of the size of operations,

the hands-on management technique employed in the industry and last, but by no means least, the need for employee flexibility in job designation in order to promote flexible work practices. Many remanufacturing firms utilize job rotation schemes, deploy workers to areas where they are best suited (in contrast to the union seniority system) and promote job sharing (Price Waterhouse, 1992). Many remanufacturers feel that "the rigidity of a unionized workforce could be detrimental to operations, especially where job flexibility is required" (Price Waterhouse, 1992, p. 36). Furthermore, unionization and the perceived confrontational atmosphere is "not considered desirable in the context of remanufacturing where a cooperative atmosphere, flexibility in work scheduling and quality consciousness are paramount to success" (Woodbridge, Reed and associates, 1984, p. 9). As such, reports indicate that remanufacturing firms are generally non-union; the exceptions typically are the larger specialty product sawmills where workers throughout the corporation are represented by the International Woodworkers Association (IWA).

In contrast to one of the specialty sawmills interviewed, none of the five non-tenured remanufacturing firms interviewed were unionized or had ever been unionized. None of the firms had undergone pressure to become unionized and the managers stated there were no major complaints from the workforce. Within the remanufacturing firms, there was an emphasis upon a management - employee relationship based upon communication and employee rewards for good service. However, as a reflection of the non-union status, wages and non-wage benefits were lower than for equivalent union workers, although non-wage benefits did not vary within individual firms. Evidence suggests that the benefits of non-union status to management vary from firm to firm. Two firms stated that unionization would possibly push them out of business due to the increased wage rates, whilst the other three firms suggested that unionization would adversely affect their firm due to the decrease in labour flexibility. As such, all non-tenured remanufacturers viewed unionization as detrimental to efficiency; the contractor and capacity subcontractor were particularly concerned about increased labour costs, while the

specialty subcontractor and 'independent' remanufacturer expressed concern regarding increased job demarcation and seniority rules. That is, unionization raised different concerns for the interviewed firms depending on their position within the production system, a point to which I shall return in chapter 4.

Of the five firms interviewed, only Firm B (a capacity subcontracting firm) had a strict labour seniority system affecting internal promotion and lay-off/rehiring practices. This seniority system may be a reflection of the limited requirements for flexibility within the capacity subcontracting firm, where production is of relatively low value and based upon larger volumes than other remanufacturers. These other remanufacturing first stated that seniority only counted at holiday times, emphasizing that worker enthusiasm, learning ability and range of skills were the most important factors determining employment security and job promotion.

Evidence from the interviews also indicates that the type of labour flexibility utilized by the remanufacturers is, in part, a reflection of the position of the firm within the production system (see also chapter 4). For example, specialty subcontractors (Firms D and E) and independent remanufacturers (Firm A) encouraged a functionally flexible workforce, thus enabling the workers to perform a wide variety of tasks and thereby provide internal product flexibility, and increased quality control for high-value products. By contrast, the contractor (Firm B) utilized financial flexibility, with limited functional flexibility. Through contracting out, Firm B externalizes the high-value, specialized tasks to subcontractors, performing only the unsophisticated, initial sorting tasks in-house. Consequently, functional flexibility comprises only a few basic tasks such as working the green chain and trim-saw, whilst the firm emphasizes financial flexibility through relatively low wages and benefits. The capacity subcontractor (Firm C) emphasizes numerical flexibility. As a capacity subcontractor at the low-value sorting end of the production process, Firm C performs relatively repetitive tasks in long runs for contracting firms who wish to externalize the initial stages of production which add relatively little value. As

such, there is little emphasis upon functional flexibility. With each worker dedicated to a specific machine, temporary workers are used to cope with fluctuations in demand.

Functional flexibility was perhaps the most significant form of labour flexibility advanced by the interviewed firms. All but one of the firms (Firm B - the capacity subcontractor) utilized a functionally flexible workforce, although the extent of polyvalent skills varied from firm to firm. Within these firms all of the full-time employees working in the production yard (that is, excluding office workers) were trained to perform more than one task. The major reasons cited by managers for encouraging a polyvalent workforce were to improve the efficiency of labour deployment and to encourage worker interest in the whole production process in order to improve the quality of the product. As the manager of Firm D pointed out,

> we are very flexible, everybody can do a broad range of things. It is not like [much of the traditional sawmill industry in British Columbia], 'you are the grader, you are packaging, you are doing the shipping', everybody is doing everything...Even the people that are basically in a labouring position have a full range of understanding of the products, it makes your decision making better, makes better production volumes and makes our product better. That is why it is in our interest to get everybody tuned into every stage of manufacturing.

Job rotation occurs informally in the four firms using polyvalent workers, the capacity subcontractor not rotating labour since employees are limited in skill to the job they are performing. Every worker in the yard is involved (to varying degrees depending upon training) in the job rotation scheme, with the exception of employees performing highly specific jobs, most notably the forklift driver who performs only the one job in order to promote continuity in storage. Production workers rotate in part on a voluntary basis whereby workers choose to switch jobs with another worker, but perhaps more significantly, production workers are deployed in accordance with their abilities and the processes required to produce the product at hand. For example, the manager of Firm D informed me, "the production foremen look at the order file that we have to get out in the week following and they look at the crew that they have and make a crew list every week. The next week the same people might be on different machines working on different tasks,

depending on the order file". As such, production workers are trained over time, often up to five years, to understand the majority of tasks within the firm. The majority of training is on-the-job, with occasional visits from tradesmen in the industry and the use of community colleges for grading training. As such, workers are trained starting from working on the green chain, to trimming and chopping, to operating the planers and moulders, and through obtaining a grading ticket and working in the firm for several years, grading. Under this scheme, employment security is obtained directly from the variety of skills known and the responsibility held by employees. With the use of incremental wage increases for each job the worker is able to perform, workers are often encouraged to educate themselves with the variety of tasks in the firm. As such, wages and seniority are indexed not to the job the employee *actually* performs but rather to what jobs he or she is *able* to perform. In this way, managers attempt to reduce the rate of turnover of skilled 'core' workers by rewarding them financially for increased responsibility. As such, workers may best secure employment through their ability to perform a variety of tasks, thereby reducing the probability of redundancy. In this way job or task security may increasingly become replaced by employment security obtained by an ability to perform a variety of jobs. However, despite the positive impacts of functional flexibility, polyvalent skills may represent a method of employee intensification whereby each worker is always able to continue working by moving from one task to another with no break.

The more peripheral workers in the remanufacturing industry are those employees lacking the variety of skills required in order to be efficiently deployed within the firm. Two main categories can be identified. The first category of peripheral workers are those full-time workers who have not been in the firm or the industry long enough to acquire the variety of skills to earn employment security through functional flexibility. These workers are generally the least senior in the firm, often lacking benefits since they have not worked long enough to become permanent, and are the first to be laid off in economic downturns. However, it should be noted that this employment security is not *necessarily* indexed to

time spent with the firm since quick learners gain security more rapidly than others. These workers offer financial flexibility since wages are relatively low. For example, Firm B paid entry level employees $8 an hour.

The second category of peripheral employees are part-time and temporary workers, providing numerical, and in some instances financial, flexibility. Only Firm D hired any part-time labour, these people being employed in a retail operation run by the firm to service local demand in the summer months. These part-time workers are all school pupils, employed three or four days a week depending upon demand. However, part-time workers are rarely employed in the remanufacturing industry since the majority of full-time workers have the breadth of skill to operate the variety of machines. As such, when a certain product line is completed, a worker can transfer to a different machine. As a result production workers are utilized for the full eight hour shift. In times of increased demand each firm hired temporary workers to increase production capacity, providing numerical flexibility. Reflecting overall trends in the remanufacturing industry, all temporary workers were male. Managers noted that there was a tendency for these workers to be either younger than 25 (occasionally university students working in the summer months) or over 45 due to availability, "a lot of them are unskilled and out of work in the recession". Temporary workers were generally paid either entry level wages or a few dollars lower, depending on the firm and their skill, and no temporary workers received non-wage benefits until three consecutive months of employment, at which time they would become 'permanent'. Due to the fluctuating nature of demand and supply in the remanufacturing industry the turnover rate of temporary employees is high. It was noted by some managers that temporary workers are rarely employed more than three or four months since they are enrolled for a specific order file and these rarely last longer than three months due to fibre supply deficiencies. As a result, Firm B changed the trial period of temporary workers from three to six months so as to save on paying benefits to the transient workforce. The manager noted that many of the workers would be laid off within four months, receiving

benefits for the fourth month. By lengthening the trial period to six months the firm avoids paying benefits to the most transient workers. This provides Firm B with financial flexibility.

The employment of women in remanufacturing firms is minimal, with a total of 25 women out of a total 155 full-time workers employed by those firms surveyed. However, where women are employed full-time, 52% work as clerical support staff, in comparison to 6% of full-time males, with 36% employed on production, 12% on tallying and only one woman employed in administration. However, within the surveyed firms there is no indication that these positions are paid less than equivalent male positions.

Employee hiring in the remanufacturing industry has three characteristics. First, there is a strong family connection within the remanufacturing firms, whereby enrollment occurs through word of mouth to family and friends. As the manager of Firm D expressed:

> I would say that the strongest part of company enrollment is word of mouth through family and friends. We are a pretty tight knit group, there are not many people here who aren't related to somebody, so there is a lot of peer pressure on people who are coming here. First of all they won't even bring that person if they think there is a chance of there being a problem, and secondly when they get here they get some help and understanding of how this company works and how the management system works along with the production systems.

In the absence of unionization this family peer pressure may operate to regulate employment in the firm, ensuring employees work hard so as not to let their family down, and may act as a cheap method of ensuring that new recruits fit into the firm quickly. Second, employees are hired from the local area through an informal 'walk-in' enrollment system. Managers stated that the Lower Mainland has a good local labour market for the remanufacturing industry due to the availability of labourers with forestry experience due to layoffs in the sawmilling industry over the past decade so that there is little difficulty in finding suitable employees. Third, if business continues to grow then temporary employees eventually become permanent and are assimilated into the firm through increased training.

Remanufacturing firms therefore stand in contrast to the highly unionized, rigid production practices associated with the primary manufacturing industry in the province. Through the utilization of a social division of labour remanufacturing firms achieve external flexibility, whilst contrasting methods of technological and labour organization provide firms with internal flexibility.

Remanufacturing and Flexible Specialization

Government and consultant reports have increasingly recognized the importance of inter-firm linkages in the Lower Mainland, linkages not only between non-tenured firms but also between large corporations and small remanufacturers. Whilst many large firms are attempting to further process their lumber themselves there is increasing pressure from government, in the form of the Small Business Forest Enterprise Program (SBFEP) for example, for a cooperative relationship. In this cooperative relationship large firms more readily supply small firms with lumber in return for value-added products or custom service. As MacMillan Bloedel note, "the most successful B. C. wood remanufacturers often tend to be smaller companies that can adapt and adjust their production more easily to meet market demands. Frequently MacMillan Bloedel...finds the best fit is to work as an informal partner with such enterprises - first, by supplying raw material, and then by distributing or marketing the finished products" (MacMillan Bloedel, 1991, cited in Jeffery, 1992, p. 46).

The utilization of small firms by large 'majors' has been accompanied by an increase in the use of subcontractors and the development of joint venture and partnership arrangements between firms. For example, where small remanufacturing firms have been awarded timber rights under the SBFEP many of them have turned to logging companies or primary sawmills to perform the harvesting, in return for remanufactured products.

The prospect of a cooperative relationship between primary sawmills and independent remanufacturers has helped focus attention upon the need for inter-firm

transactions in a competitive and cooperative environment. As mentioned previously, within the remanufacturing industry, production occurs within individual firms who are part of a social division of labour featuring inter-firm transactions of product and processes. The geographical distribution of remanufacturing further suggests the existence of a social division of labour based around a few industrial districts, dominated by the Lower Mainland. Upon studying the value-added industry Jeffery (1992) notes the existence of geographically clustered enterprises linked by inter-firm transactions. Jeffery (1992) describes these inter-firm relations in a way reminiscent of Marshall's discussion of industrial districts:

> the independent value-added sector has several strengths on which to continue building. Pre-eminent on this list is the regional clustering of the existing industry...creating a number of competitive advantages. Remanufacturers located in proximity to primary sawmills [and I would argue other remanufacturing firms] can reap the benefits of short, close geographic lines of communication, quick and constant flow of information, ongoing exchange of ideas and innovations and access to and creation of local supporting industries capable of cost-effective, high quality inputs and services. This creates a powerful spillover that enhances and effects innovation and competitiveness and creates local rivalries...[which]...can provide long-term economic advantages and stability for the sector and the corollary social benefits for the communities in which they are located (pp. 56-57).

This evidence suggests that the remanufacturing industry, and the value-added sector to which it belongs, stands in contrast to traditional forest product production in British Columbia and exhibits many of the characteristics of flexible specialization in order to overcome market fragmentation, changing consumer demands and supply instability. Evidence within this chapter indicates that the majority of remanufacturing firms are small, owner-managed enterprises, utilizing a social division of labour, and linked through a complex array of inter-firm transactions. The nature of these transactions are explored in greater detail in chapter 4 through in-depth case-studies. Furthermore, remanufacturing firms service niche markets and specialized consumer demands through the batch production of unstandardized products. The majority of remanufacturing firms are non-union, with labour organization emphasizing the importance of labour flexibility, especially in regards worker tasks. This evidence supports the characteristics of flexible

specialization advanced by Storper and Scott (1989). However, the use of sophisticated technology within the remanufacturing industry is limited, with few firms employing computers in the production process. Rather, remanufacturers utilize unsophisticated, general purpose machinery in the production of a wide variety of products, thus supporting the suggestion that flexible technology is most appropriate for large rather than small firms (Kelley and Brooks, 1988).

Chapter 4

The Remanufacturing Production System: the perspective of the independent remanufacturer

In chapter three the remanufacturing industry was studied in the context of the forest product industry with the aid of secondary data and industry interviews. Evidence suggested that the remanufacturing industry in the Lower Mainland operates as a flexibly specialized production system, utilizing a combination of external flexibility through a social division of labour, and internal flexibility through technological and labour organization.

Through the use of in-depth case study material, this chapter attempts to understand the remanufacturing production system specifically from the perspective of four independent firms, (Firms A, B, C and D). Such an approach is necessary in order to investigate flexibility within each firm rather than the production system as a whole, since the nature of flexibility may vary according to the role of the remanufacturer in the production system. All four 'independent' remanufacturers studied in this chapter share characteristics which distinguish them from the corporations investigated in chapter 5. First, independent remanufacturers are non-tenured, that is, each firm does not own cutting rights to provincial crown forest land and is therefore dependent upon the tenured forest product firms for fibre supply. This dependence upon tenured firms, principally primary manufacturers, is associated with supply uncertainty and insecurity, since large corporations have traditionally viewed remanufacturers as competitors rather than consumers. The situation has been compounded by a lack of flexibility within primary sawmills to cut to specifications required by remanufacturers and the decrease in high quality timber within the industry. These pressures have resulted in the intensification of competition for fibre and a subsequent rise in the cost and uncertainty of fibre supply for remanufacturers. Second, independent remanufacturers are generally small. None of the

independent firms interviewed employed over 60 full time workers and their volume of output averaged only 20 million board feet per year (in comparison to 1,635 million board feet of wood products produced by the parent of Firm E in 1991). Third, in contrast to large corporations, the independent remanufacturers surveyed are single plant enterprises and have no affiliated activities within the forest product industry. Fourth, these independent remanufacturers are owner-managed and as such lack the resources available to the large corporations in terms of finances and management time in order to carry out expensive research and development and marketing.

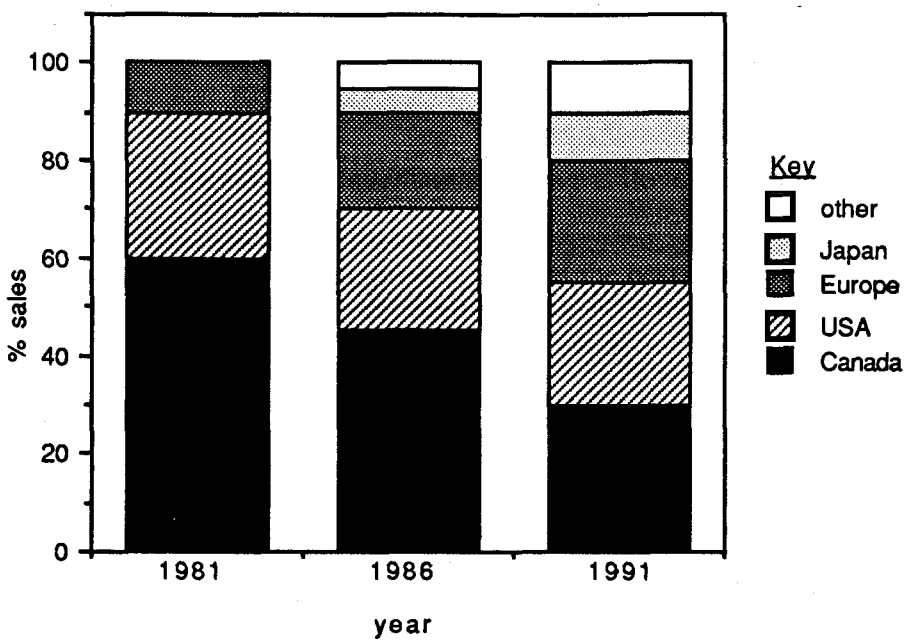
Details from in-depth, case-study interviews reveal a range of strategies to attaining flexibility, of production possibilities and of management choices, the consequence of which creates a variety of experiences within the industry. In many ways each case-study is similar as a result of the independent nature of the firms. However, at the same time, each case is made distinctive due to the individuality of management decision making and the position of the firm within the production system. Each firm may therefore utilize a specific strategy of flexibility, the nature of this flexibility varying in terms of product mix, markets served, investment in machinery, and the form of labour organization. The use of case-studies helps reveal the variety of experience within the production system and the nature of flexibility within the independent remanufacturing firm, making it possible to understand the rationale underlying diverse forms of flexibility in a single production system.

Firm A

As an 'independent' remanufacturer, the distinctive character of Firm A is that it processes 85% of its own lumber in-house, performing no subcontracting services for other firms. As such, this firm is distinguished from contractors which contract out a large proportion of production to custom firms, and from subcontractors who perform a service by processing lumber for other companies.

The main products produced by Firm A were sidings, paneling and window and door components. This product mix is fairly representative of the Lower Mainland remanufacturing industry as a whole. As shown in figure 4.1, the markets of firm A have changed. In particular, between 1981 and 1991 the importance of Europe has increased

Figure 4.1 - Markets of Firm A, 1981, '86, '91



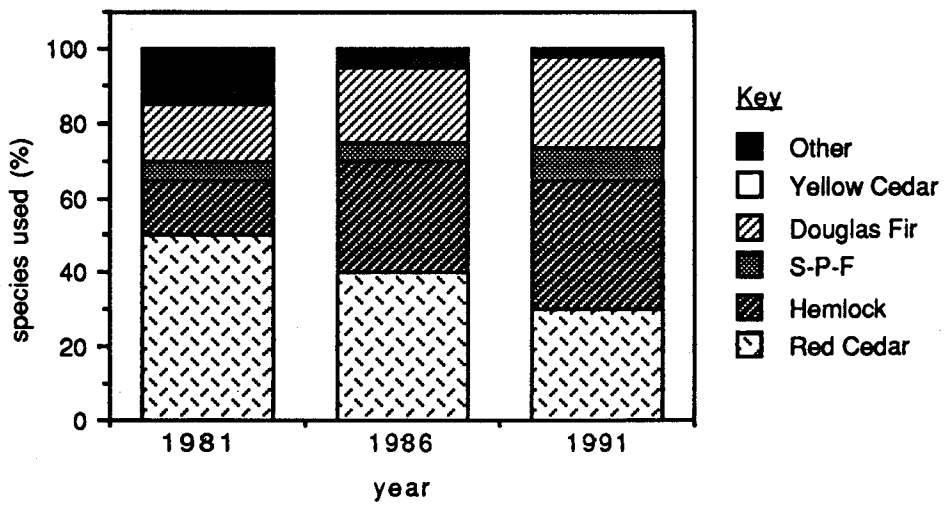
Source: primary research

significantly from 10% to 25% of Firm A's sales. By 1986 Firm A was also serving Japan and other markets (mainly Taiwan), and by 1991 these markets accounted for 20% of sales by Firm A. Because it owns the lumber it processes, firm A has the opportunity to target certain markets via the production of certain products. Thus there has been a marked increase in the production of window components from hemlock for the German and Japanese markets. Associated with the increased importance of off-shore markets is the stagnation of sales within North America. Between 1981 and 1991 sales to the United States declined by 5%, whilst sales within Canada fell from 60% to 30%. Thus exports

(outside North America) have risen from 10% to 45%. In this respect firm A is representative of much of the remanufacturing industry in the Lower Mainland, at least by showing a diversification of markets away from United States markets towards European and Asian demand. The export tariff imposed by the United States in 1986 was cited as a cause for the decline in sales to the United States. The fall in importance of the Canadian market for firm A however, which is contrary to industry wide experience, was attributed to the recession of the past five years and the increased use of alternative materials in Canadian construction (such as aluminum windows and PVC sidings).

Accompanying this fall in North American consumption is the decreased use of cedar as the main species used by firm A (see figure 4.2). As was mentioned previously, the quality and consistency of cedar has fallen due to decreases in the annual allowable cut and primary growth timber. This decrease in fibre availability has been accompanied by increased competition and associated increases in price. The culmination of these

Figure 4.2 - Fibre used by Firm A by species, 1981, '86, '91



Source: primary research

pressures has, in the view of firm A, increased the risk and uncertainty involved in processing cedar products. As such, between 1981 and 1991 the processing of cedar in-house by Firm A fell from 50% to 30% of total fibre processed. Firm A currently contracts out 15% of its production volume to local firms, nearly all of this contract work involving the processing of cedar. By contrast, in-house production of light wood species for export markets has become more important, with Douglas Fir and hemlock comprising 25% and 35% of utilized fibre respectively. Investment in machinery by firm A is reflective of its position within the production system and industrial strategy. Firm A only contracts 15% of its lumber out to subcontractors, this work generally going to capacity subcontractors for initial breakdown. As such, investment has focused upon the introduction of machinery for the manufacture of a variety of high-value products. The most significant investments in the last decade were the purchase of small dry kilns with which to dry lumber in small batches for the niche demands of the customer. In addition, a larger green chain and resaw were purchased in order to increase their product mix and overall productivity. With the purchase of computer controlled dry kilns firm A may be viewed as having a medium level of technological sophistication within the remanufacturing industry. This investment has influenced the nature of labour flexibility.

Table 4.1 - Employment type in Firm A, 1981, '86, '91

	1981	1986	1991
Full time	13	28	40
Part time	0	0	1*
Temporary †	3	10	10
Total	16	38	51

* part time worker in 1991 works on tallying in the kiln drier.
† temporary workers are working on the green chain and casual jobs (tallying)

In 1991 firm A employed 40 workers full-time, compared to just 16 in 1981. As is common in remanufacturing firms, only one worker was employed part-time, a woman tallying lumber in the kiln-drying process. Ten temporary employees were employed in 1991 (see Table 4.1). However, as the manager pointed out, "they were never here at the same time. It may only be one month's work because you have a second shift on. It is not a great situation, it is the migratory part of the business shall we say". Within the firm it was rare for more than 4 temporary employees to be working at the same time. These temporary employees provide the firm with numerical flexibility and are employed as labourers, working on the green chain and other casual jobs such as tallying in times of high market demand. Firm A is a non-union firm and the wages are below union levels. The entry level wage is $12.75 in comparison to $17 for entry level production workers in the IWA - Canada. This margin is effectively eliminated in one particular occupation, that of a grader who earns $19 in both Firm A and under the IWA - Canada collective agreement, firm A offering these high wages in order to compete with unionized plants to attract high quality, skilled tradespeople.

To the manager of firm A the key advantage to non-union status is the flexibility of labour organization, whereby functionally flexible workers may be scheduled for a variety of jobs depending upon demand. As the manager noted, "(unionization) would be the kiss of death because of the flexibility, not the money but the flexibility". Within firm A each full-time employee performs at least two or three different jobs, including planing and moulding, with one third of these workers being qualified graders. This functional flexibility is developed through an informal job rotation scheme designed to most efficiently deploy the workforce, supplemented by grading courses provided by industry associations. As the manager stated, "we probably have eight or nine qualified graders and we may only use three or four [as graders] at any one time. For example, this morning a junior millwright was out trimming on the trim-saw because there is not enough work for him to do the other side. The next time you see him he will have a loading hat on". This

functional flexibility and the lack of strict job demarcation increases the employment security of the full-time workers. As the manager noted, "we are now doing two shifts whereas we used to do three shifts. Nobody went, they were just assimilated somewhere else in production".

In-house training is an ongoing process with workers rewarded financially for the number of tasks they are able to perform. For example, when a worker acquires a grading ticket he/she receives a 50 cent an hour pay increase. Functional flexibility benefits the firm in a number of ways. First, the efficiency of worker utilization is increased through the scheduling of workers to best suit demand, and second, a knowledge of the production process as a whole increases quality control, producing a more reliable and high value product.

Firm A therefore attains flexibility through the use of general purpose technology which is able to manufacture a variety of high value products, emphasizing both functional and numerical flexibility within the labour force.

Firm B

Firm B acts as a contractor in the remanufacturing production system. 50% of total firm production is carried out by local subcontractors on a custom basis. These arrangements are not reflected in formal contracts. Instead, agreements take place over the phone or by fax and occur opportunistically as demands dictate. Although a variety of firms are used to attain a wide product mix, firm B relies heavily upon five subcontractors, four located in the Lower Mainland, the fifth in Northern Washington State. Over time firm B has built up a relationship with these firms, each of which performs a specific role in the production process for the contracting firm. Through the use of subcontractors, firm B attains flexibility in production and an ability to react quickly to market changes. This production strategy is reflected most dramatically in the utilization of technology and labour within the firm.

Firm B contracts out the more sophisticated production processes to specialty subcontractors, but performs the initial (less sophisticated) stages of production in-house. In performing these initial stages of remanufacturing firm B does not require sophisticated equipment. Rather, the firm uses basic machinery purchased second hand from sawmills, machinery which was too slow for volume production but which is suitable for the wide product mix produced in remanufacturing. When kiln drying, laminating, edge-gluing or other value-adding processes are required, firm B uses subcontractors. As the manager pointed out:

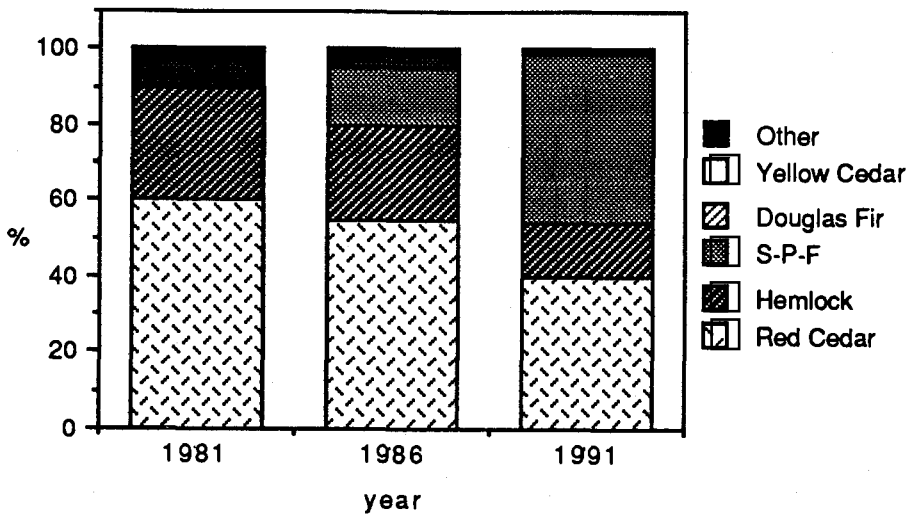
> "probably the bulk of our remanufacturing is done on a custom basis by outside companies. What you see here is very basic. We have a sorting chain, a rip-saw and a chop-saw, that is it, we have no planer, moulders, resaws, dry kiln, any of the more sophisticated equipment...it is not the best at anything but it can do pretty nearly anything, and when production becomes a major factor sometimes it is better to send it out elsewhere where we can get the gain of their productivity".

Through the externalization of specialized processes firm B attains flexibility in product mix whereby customer requests are satisfied through the use of social division of labour, each specialized process performed by the firm best suited to that tasks, the sum of the processes eventually creating the finished product. As the manager points out, "we think we are more flexible than our competitors because we can do a lot of different things. We are not necessarily doing them but we can arrange to get them done...Certain plants are better at doing certain things than others, so we hone in on those ones".

The use of subcontractors enables firm B to react quickly to changes in the market and fibre supply by changing or adding new subcontractors. As noted, "before we do that (invest in new machinery) we would look at having somebody else do it for us. The benefit of not investing in a lot of fixed capital is that it gives us a great amount of flexibility. We can change our product mix by taking up and dropping subcontractors as we need to". As such, the strategy of firm B is based upon the use of the social division of labour within the remanufacturing industry of the Lower Mainland. This strategy benefits firm B in three ways. First, externalization of production avoids the initial expense of

investment required to perform sophisticated tasks. Second, the use of subcontractors allows firm B to externalize the risk and uncertainty associated with an unstable and inconsistent fibre supply. Third, contracting out allows firm B to increase product and market flexibility, enabling the firm to react quickly to changes, including changes in markets and changes in the softwood lumber tariff imposed by the United States. The flexibility of firm B to changes in fibre supply is exemplified by the decreased use of cedar

Figure 4.3 - Fibre used by Firm B by species, 1981, '86, '91



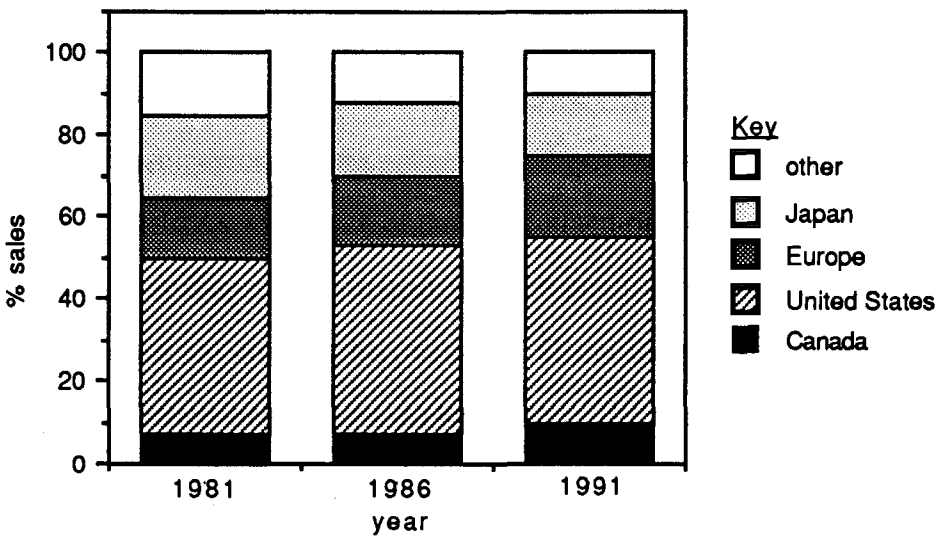
Source: primary research

and hemlock in order to reduce supply uncertainty (see figure 4.3). Between 1981 and 1991 the utilization of cedar fell from 60% to 40%, and hemlock from 30% to 14%. Firm B cites fibre inconsistency, supply instability and increased price as the causes for this marked decline. Furthermore, the flexibility of firm B to adjust to market dynamism is exemplified by the increased use of S-P-F, which began in 1986 and accounted for 45% of fibre by 1991. The use of S-P-F by firm B is mainly for the European, Japanese and other markets (Australia and New Zealand), in total accounting for 45% of the market in 1991 (see figure 4.4), a marginal decline in the importance of offshore markets in contrast to the

industry overall. This change in species is a reflection both of increasing competition and fibre cost (decreasing the attractiveness of cedar and hemlock) and the increased availability of lumber from interior mills (increasing the attractiveness of S-P-F).

Firm B currently employs 15 workers full-time, compared to only 6 in 1981 (see table 4.2). Of the 15 employees only one is female, performing both administrative and clerical tasks. Eleven of the full time workers are employed in production and are the most affected by economic fluctuations, producing a highly transient workforce. No part-time

Figure 4.4 - Markets of Firm B, 1981, '86, '91



Source: primary research

workers are employed. As the manager noted, "we either need somebody full-time or we don't. Having people work on a part-time basis is not something that we have really thought of. When the business picks up we take people on to be full-time, permanent employees". Firm B does not employ any temporary workers. However, due to low wage levels for entry level workers ($8 an hour) and the recent recession, the labour force has been characterized by a high rate of turnover. As the manager pointed out, "they are

not hired intending to be gone in a few weeks, the intent is to keep everybody on all the time, there is attrition anyway at our wage level. So while it is not our intent to hire temporary people in effect it does happen that way...[furthermore]...our wage scale basically dictates the type of help that we get, which is inexperienced. That is okay, we are

Table 4.2 - Employment type in Firm B, 1981, '86, '91

	1981	1986	1991
Full time	6	10	15
Part time	0	0	0
Temporary	0	0	0
Total	6	10	15

Source: primary research

getting what we pay for". When asked whether firm B was unionized the manager laughed, "No, not with those wages!', arguing that unionization would increase wages enough to end in-house production. Consequently, production workers perform generalized tasks such as sorting lumber and working the chop and rip-saw, tasks requiring minimal training and investment in the individual employee. There is a low level of job demarcation. Each worker is expected to perform the variety of basic tasks involved with in-house production. As the manager notes, "we have a forklift driver, a supervisor and a trainee grader; the rest are labourers who can get assigned to any of a number of things out in the yard, piling lumber, feeding the multi-rip saw or doing the chopping on the chop-saw". However, these workers are not as highly trained as the functionally flexible workers described in firm A. In firm B these workers only perform initial breakdown tasks and do not engage in quality control.

Due to the transient nature of employment, production workers are now required to have completed six months of full-time employment with the firm in order to receive non-wage benefits. In this way the firm saves money since many workers leave prior to claiming benefits and the firm only rewards those workers with at least six months in-house training. The low level of investment in in-house production workers is largely a reflection of the use of subcontractors to perform the high value-adding production processes whilst firm B concentrates on sorting the lumber and carrying out low-value processes. As the manager noted, "we use other peoples equipment on a custom basis, therefore we don't need the trades people, the millwrights, even the graders, we pay other people for those services". The rationale underlying this dependence upon subcontractors was expressed by the manager in the following way:

> "Once we asked one of our subcontractors, 'based upon the lumber that you process for us, if we were running that lumber at our own plant how many people would we employ?', the answer was eight. At that time we were only employing six people at our own plant. We were employing more workers at that one subcontractor than we were ourselves. That is just one subcontractor, never mind the other ones that we were producing at. We would have to spend $200,000 to $300,000 on machinery to reach that capacity internally, and we would still not be sure if our supply is going to continue for those items. We could be sitting here with a $300,000 facility that has no way of generating revenue. That is enough to keep us from doing it, so we subcontract it".

A further rationale underlying this production strategy is the aspirations of the manager. Rather than invest in machinery, processes are contracted out so as to reap high levels of profit whilst maintaining production flexibility in order to minimize risk and uncertainty. As the manager states, "we are not investing in a lot of capital but use custom remanufacturers instead. That gives us a great amount of flexibility so we can change our product mix by taking up or dropping subcontractors as we need to". As such, it may be expected that the use of subcontractors would be encouraged by a period of industrial uncertainty and change.

Firm B therefore achieves flexibility through externalizing the more sophisticated processes and varying the use of subcontractors as demand necessitates. Consequently,

investment is focused upon low technology machinery and the creation of a financially flexible workforce.

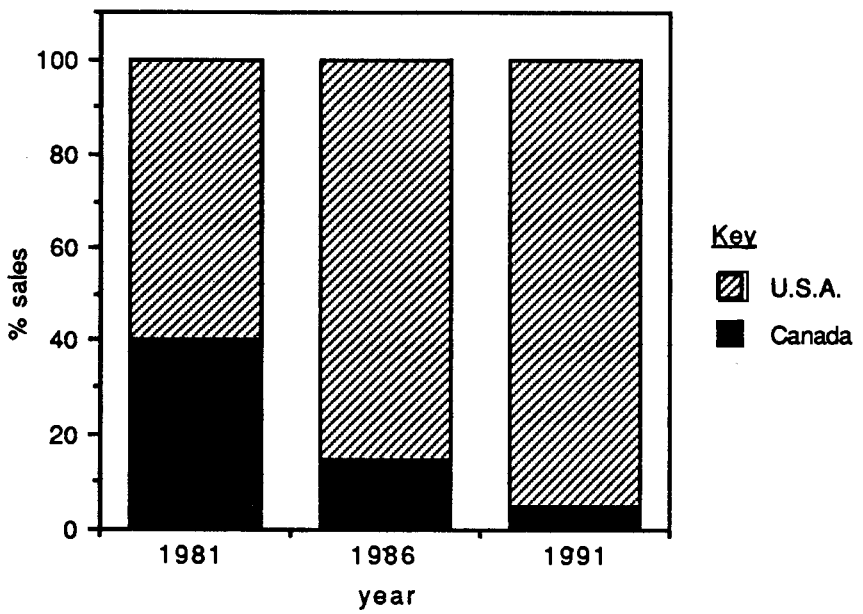
Firm C

Remanufacturing firm C may be described as a 'capacity subcontractor'. Acting as a subcontractor, or custom remanufacturer, firm C provides a service to other remanufacturing and manufacturing firms by processing the lumber of contracting firms. At least 95% of all production performed by firm C occurs on a custom basis and as such the firm has little influence in what product is produced or what markets are serviced. As such, firm C is largely reactive to changes within the remanufacturing industry, serving the changing needs of relatively proactive contractors. Firm C is used largely to enable contracting firms to reach capacity in the initial stages of remanufacturing, performing basic breakdown and sorting processes to allow further processing further down the line. As such, in contrast to the mouldings, window and door components, and laminated wood products produced by many remanufacturers, the product mix of firm C consists mainly of cedar decking and dimension lumber (1x4, 1x6, 2x6). The use of firm C as a capacity remanufacturer is reflected in the wood fibre processed, the markets served, the relationship with contractors, the technology utilized, and the nature of labour flexibility within the firm.

The use of cedar by remanufacturers in the Lower Mainland has decreased because of a decrease in the quality, consistency and stability in the supply of cedar, and its increased price per thousand board feet. Consequently, in-house production of cedar products in the industry as a whole has fallen relative to other fibres utilized. However, unlike many remanufacturers, firm C processes only red cedar lumber, focusing increasingly upon serving the United States market via local contractors, (see figure 4.5). As was mentioned in the case of firm A, other remanufacturers are increasingly shifting to European and Pacific Rim markets at the expense of the United States. This

tendency has been intensified by economic recession in the United States over the last few years and the introduction in 1986 of export tariffs placed on softwood lumber entering the United States from Canada. These pressures have resulted in increased uncertainty in the remanufacturing industry and wood products industry as a whole. As such, the use of cedar and reliance on the United States market has become marginalized in the remanufacturing industry. Independent remanufacturers have chosen to externalize risk and uncertainty through the use of subcontractors such as firm C.

Figure 4.5 - Markets of Firm C, 1981, '86, '91



Source: primary research

As a subcontractor, remanufacturing products for the United States, firm C is increasingly producing semi-finished rather than finished products to supply manufacturers south of the border. This shift towards products with less added-value is explained by the imposition of tariffs upon value-added softwood exports. In order to minimize costs, manufacturers in the United States are choosing to perform value-added processes themselves rather than

pay the increased cost of the product produced in Canada. Furthermore, the opportunity for firm C to move to new markets and new products is limited by the reactive nature of capacity subcontracting and the inability to break out of what may be termed a 'subcontracting trap'. The manager related that in the past the firm had attempted to become more proactive by purchasing their own fibre supply but found it difficult to sell the product. As he noted:

> "I have bought some (lumber), processed it and lost money on it. It is not hard to buy,...the biggest problem is that you have to have a sales organization to sell it. I have got no-one to sell for me. For me to sell it I am trying to sell to the customers that I am doing all the custom work for, so if I try to sell to their customers I won't be doing any work for them."

As such firm C finds itself adopting what may be viewed as an unfavourable industrial strategy with little opportunity of change.

The relationship between the capacity subcontractor and the contracting firms may be viewed as unequal. As with much of the remanufacturing industry there rarely exists a formal contract, with remanufacturing firms often purchasing lumber opportunistically. The absence of a formal contract between firm C and its contractors results in supply instability and production inefficiency. As the manager noted:

> They don't give you anything in writing as to what volume they will give you per month. If the market is good then you have got no problems, you get as much volume as you can handle. If the market is poor then you have a tough time...When they need you they will pile wood on you, but when things slow down for them you also end up with nothing.

Furthermore,

> Last year was a bad year, we might have lost three weeks production in the whole year. This year will probably be the same, through lack of work. You have no control over it.

As such, firm C holds relatively little power in the remanufacturing production system, being reactive to changes in the remanufacturing industry, and as a capacity subcontractor is acutely affected by economic downturns whereby contractors stop externalizing production in order to efficiently operate in-house production.

Evidence suggests that as a capacity subcontractor, firm C is used by contracting firms to carry excess inventory. As the manager related, "some of the companies that I do work for have probably half a million to a million feet of lumber here which they haven't sold. It is processed but not sold. It is free storage for them". The manager noted that the tendency for firms higher in the production hierarchy to use the firm as a storage site has increased in recent years:

> "a lot of these brokers had their own yards. Now to keep these yards would cost them $100,000 a year. Doing away with those yards by using companies like myself they don't have that overhead and they are still producing the same products and volumes. It is definitely a trend and I think it is going to get more full here all the time as these companies are using someone else's facilities as storage".

This suggests that there continues to be a need for just-in-case inventory and that storage is provided by those firms lower down the production hierarchy. Consequently, in a production system where supply and market uncertainty exists inventory stock-piles may be necessary at the lower tiers of the production system in order to ensure smooth production and supplies for firms at the consumer end of the production system.

The use of machinery in firm C may be viewed as reflective of the firm's position within the remanufacturing production system. Within the social division of labour, remanufacturers do not perform the same processes. Rather, each firm specializes in a small range of processes and is either subcontracted to perform those specific tasks for other firms or contracts out the tasks the firm is unable to perform in-house. Within this system, firm C concentrates on performing the initial breakdown of dimension lumber into more specific dimensions or grades often for further processing by manufacturers and remanufacturers. Consequently, technology within firm C is unsophisticated, limited to a green (sorting) chain, a chop-saw and a resaw. There are no computers within the firm; a reflection of a low level of capital investment, the managers lack of experience with computers, and the instability of contract work leading to variations in dimension and grade of output within the initial breakdown process, a characteristic viewed by management as limiting the use of computer assisted manufacturing.

Investment within firm C is limited to a great extent by customer demands, that is by contractors. Evidence suggests that contractors throughout the remanufacturing industry are choosing to use subcontractors to serve markets and process fibre where there exists significant risk and uncertainty. Where there is uncertainty in traditional markets contractors may externalize risk by using subcontractors, whilst industrial growth occurs in other markets and products. As a result subcontractors, especially capacity subcontractors where specialized processes are not offered, may be locked into performing basic processes requiring little investment, research and development. Such a worst case scenario is supported by firm C, as the firm continues to be used solely to perform initial breakdown of cedar, increasingly for the United States, while relative industry output to the U. S. declines. Firm C has not invested in machinery in six years and states that, "we may buy some new equipment but that doesn't really change anything, it'll still do the same work as the old equipment was doing". The firm does not perform any product innovation or research and development since all processes are on customer request.

In contrast to the flexible, short batch production utilized by the other remanufacturing firms interviewed, production within firm C occurs in relatively long runs. Relative to production within many primary sawmills, however, production occurs in batches rather than through mass production. Production is concentrated upon a single product until all orders for that product are satisfied, at which time machinery will be set up to run a different product. Firm C is the only independent remanufacturing firm interviewed which claimed to serve a mass rather than a niche market, producing commodity items rather than high-value specialty products. In producing this commodity product for a mass market, firm C only runs one product at a time, with production occurring in large volumes. As the manager notes:

> "it could be a days run, it could be two or three days run depending upon how much volume there was...If we have enough volume to run two shifts we would run right through with the same product until we have finished it, because every time you change you are losing half an hour in there. So once you get on a run you

keep going until you complete it. I might have a run of 1x4 for three customers, so one will follow the other".

Hence production is distinct from the small batch production and multi-product runs performed by other remanufacturers. This production strategy, combined with the high inventory levels stored by firm C, suggests that within a flexibly specialized production system there exists a variety of strategies and a range of positions given varying power relations, each utilizing flexibility in distinctive ways. The internal flexibility of firm C is limited by its position within the production system (as a capacity subcontractor). Production runs occur in long batches, the product mix is of relatively low value, and the machinery is unsophisticated. However, firm C provides flexibility to the production system through storing inventory, producing relatively low-value components for other remanufacturers to process, and processing the 'overflow' work of other remanufacturers in periods of high demand, such as the end of business cycles.

Labour relations in firm C stand in contrast to the other remanufacturing firms interviewed. In 1991 firm C employed eleven full time workers, (see table 4.3). Although only six workers were directly employed on production, the two tradespersons were both expected to carry out production tasks: for firm C this is the extent of multiple skills. There

Table 4.3 - Full-time job categories by sex and year for Firm C

	1981		1986		1991	
	M	F	M	F	M	F
administrative	n/a	n/a	1	0	1	0
clerical / support	n/a	n/a	0	1	1	1
trades people	n/a	n/a	1 *	1 *	1 *	1 *
production line	n/a	n/a	6	0	6	0
other	n/a	n/a	0	0	0	0

n/a - not available
* trades people also work on production line but are not included in production line total.

Source: primary research

is no job rotation scheme within the firm and there exists a high degree of job demarcation, although the firm is non-union. The reason for this job demarcation may be attributed to two factors. First, employment is fairly stable within the firm and as such workers are not required to cover for absentees, and second, production processes are relatively standardized (that is, chopping, resawing, sorting). Consequently, there is a low level of training within the firm, and often as little as one week's training is required to operate a machine, in comparison to months or years in all other remanufacturing firms interviewed. As the manager noted, "you have to have (strict job demarcation), otherwise you would have to train more people and we are too small to really spend time training people. We have very little turnover, the same people might be doing the same job for two or three years. They are quite happy each of them doing their own little thing". This stability may be attributed to relatively high wages for full-time employees without having to learn a variety of jobs and operate a number of machines.

In the event of demand necessitating a second shift, firm C uses temporary workers to increase productivity. In total, twenty two temporary workers were employed in 1991 although generally no more than ten were used at one time. In contrast to the entry level wage of $14.50 for full-time permanent employees, temporary employees working as labourers are paid $12 an hour and receive no benefits. Temporary employees in firm C tend to be workers marginalized by age. As the manager pointed out, "you either get young people in their early twenties or older people in their late forties...These two areas seem to be where a lot of people are unemployed, a lot of them are unskilled and out of work and they get the chain jobs". As such, these temporary employees provide numerical flexibility.

Since there is limited training of full-time production workers, qualified temporary workers are utilized when grading is required on a second shift. Since firm C (as with most remanufacturing firms) pays workers according to the job they are capable of performing, not the job they carry out, the use of temporary tradespeople saves the firm

time and money on training and paying high trades wages to a worker most often performing production tasks, thus providing financial flexibility.

Firm C is distinct from the other independent remanufacturers interviewed in that flexibility is somewhat limited by its position within the social division of labour. Investment in machinery is focused upon low technology equipment suitable to process relatively low-value products in large volumes, by independent remanufacturing standards. However, as a capacity subcontractor, firm C utilizes numerical flexibility within the firm in order to cope with fluctuations in demand from contractors throughout the business cycle. This numerical flexibility allows firm C to adjust production capacity to short term fluctuations in demand without detrimental affects to efficiency. Furthermore, as a capacity subcontractor firm C enhances the flexibility of the production system as a whole by acting as a buffer to production within other remanufacturing firms and through storing inventory for just-in-time delivery.

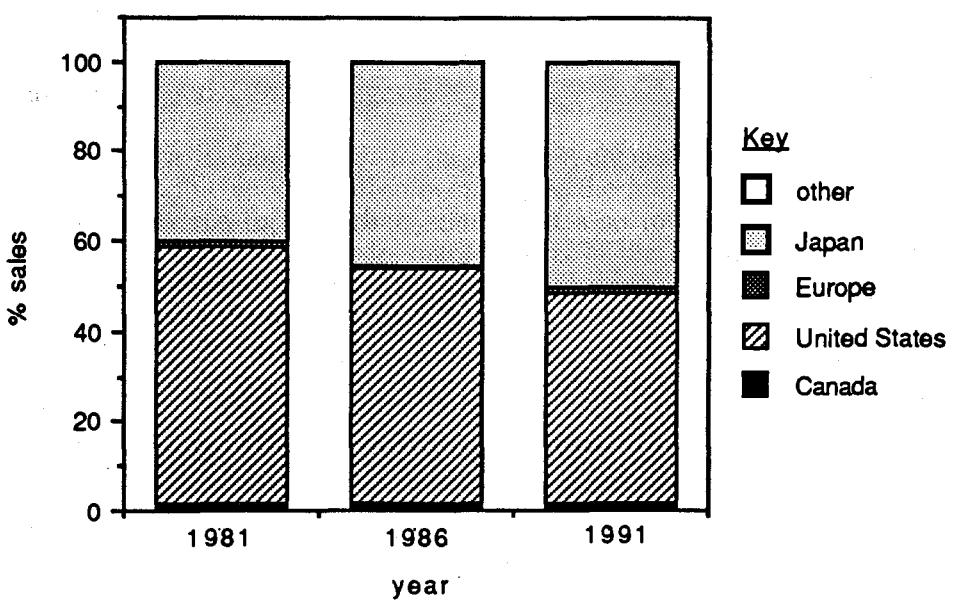
Firm D

Firm D may best be classified as a 'specialty subcontractor', contracted out by remanufacturers to perform highly specific processes generally at the high-value and consumer end of the production process. In 1981 firm D was an 'independent' specialty remanufacturer, processing 48 million board feet of lumber for its own operations and performing no custom services. The firm purchased 50% of lumber from local sawmills and supplied the remaining 50% through its own on site sawmill. However, due to diminished fibre supply and increased fibre costs which cut profit margins, firm D changed strategy. As the manager related, "the volume of available lumber was shrinking, the price of lumber was increasing, and our profit margin after we had finished remanufacturing was less. So we got away from (processing our own lumber) and we converted to a contract business. With the contract business we know what our bottom line is going to be, there are no surprises". Hence the strategy pursued by firm D has shifted focus from an

independent specialty lumber remanufacturer to a specialty subcontractor. The majority of lumber processed now occurs on a contract basis with other companies' fibre. This evidence suggests a breaking down of vertical integration on the part of firm D and an increased involvement in the social division of labour. However, firm D is not fully reliant upon contract work and continues to operate the sawmill for 44% of the lumber it processes; an attempt perhaps to retain a proactive production strategy and avoid the subcontracting trap outlined in regards to firm C.

Within the production system firm D serves a niche market via small batch production. As the manager states, "that is part of the flexibility of what we have. This company doesn't deal with volume for one minute of its life. We are product oriented, what does the end user need?" The firm produces a high proportion of high-value products, especially clear and tight-knotted interior sidings, panels and mouldings for the U. S. market in red cedar, and an increasingly significant amount of interior finish in yellow cedar for the Japanese construction market (see figure 4.6). Whilst in-house

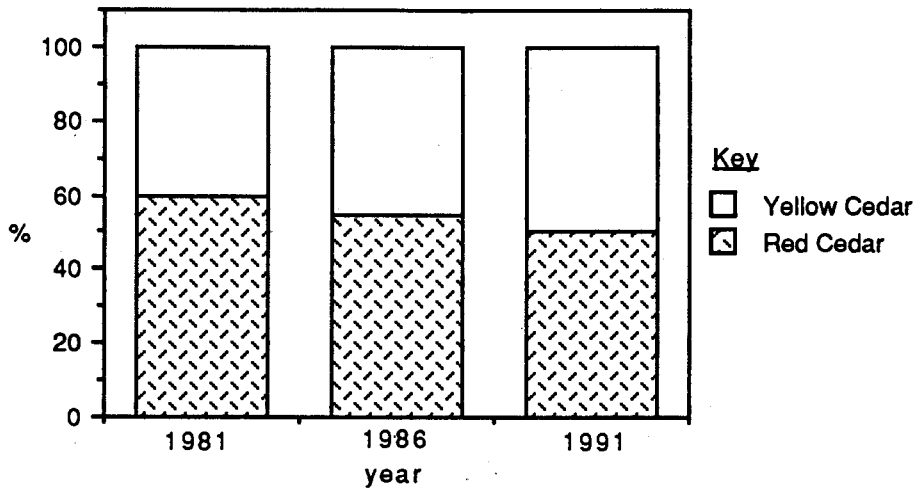
Figure 4.6 - Markets of Firm D, 1981, '86, '91



Source: primary research

production of firm D increasingly focuses upon yellow cedar for the Japanese market, from 40% in 1981 to 50% in 1991, much of the contract work continued to focus upon the processing of red cedar for the United States market. As shown in figure 4.7, there has been an increased emphasis upon the processing of yellow cedar for the production of high-value interior finish for the Japan. However, red cedar continues to be an important species for firm D, the majority of contract work involving red rather than yellow cedar for

Figure 4.7 - Fibre used by Firm D by species, 1981, '86, '91



Source: primary research

the United States. This finding supports the argument that subcontractors are being used in order to externalize the risk and uncertainty of serving specific markets and processing specific fibres. As a subcontractor, firm D processes the lumber of approximately twenty companies and states that, "we think we are in the top 20% of contract producers so we are attractive to the people that are out there who have wood to process". All of the contracting firms serviced by firm D are located in the Lower Mainland, with proximity to clients noted as extremely important to the firm in order to minimize transport costs, although of the twenty firms served three are the major base of contract customers. As with firm C, the

processes performed by firm D are contractor led. However, by contrast this specialty subcontractor performs processes of greater value and intricacy, performing kiln drying to highly specific requirements, planing to the design of the customer, and performing highly intricate mouldings. This function in the production system places firm D in a stronger bargaining position with contractors. There exists no formal contract, rather materials are persistently exchanged on a word of mouth agreement. However, there exists a core of businesses which continually utilize the services of firm D, since the processes performed are those best suited to the specific needs of the contractor. Consequently, there exists a relationship of respect and trust between the contractor and the specialty subcontractor whereby specific product demands are met and product innovation occurs on a continual basis in order to satisfy the demands of the contractor.

Investment in machinery in firm D is reflective of the firms position as a specialty subcontractor. In contrast to the capacity subcontractor discussed earlier, firm D has invested intensively in machinery in order to attract business through high quality, specialized processes. Since the mid 1980's firm D has invested in five new computerized dry kilns to increase the drying capacity to 2.2 million board feet at any one time, and invested in a moulding and packaging line. This investment has occurred in order to become a competitive specialty subcontractor and has earned firm D a reputation in the Lower Mainland for high quality dry kilning. Upon investing in computerized dry kilns firm D has increased the accuracy to which timber can be dried allowing more specialized finished products to be processed, and has increased their capacity to serve contractors. In talking with several remanufacturers in the Lower Mainland, firm D was mentioned as *the* firm with which to dry kiln lumber when narrow tolerances are required. As a producer of remanufactured products processing its own lumber, investment has occurred in order to increase the range of products the firm can produce and thus the flexibility of the firm in serving ever changing markets. As such, with the exception of the computerized dry kilns for the highly specific requirements of contractors, investment has focused upon second

hand machinery such as planers, moulders and resaws in order to produce a wide range of products. As with many remanufacturers, in-house flexibility is obtained through the changing set-up and organization of basic, low technology machinery rather than through the use of computer assisted manufacturing. As the manager argued, "the investment that you need to create a computer generated line, you need big volumes of one thing to justify a $100,000 or half a million expenditure on making a line that is restricted to making maybe five products really well and after that you start making compromises. Our business is customer oriented and job and order specific". Overall, relative to many local remanufacturers, investment in firm D has focused upon medium to high technology equipment. This has implications for labour flexibility.

Labour relations in firm D reflect the high value end of remanufacturing production system within which the firm operates. In the remanufacturing side of the business no temporary or part-time workers are hired. In 1991 firm D employed 54 full-time workers, a relatively large workforce within the remanufacturing industry (see table 4.4). The reduction of full-time employees between 1981 and 1991 from 74 to 54 is largely due to increased productivity from investment in new machinery. The increase in productivity did not cause layoffs, rather employment was shed via attrition through workers retiring and

Table 4.4 - Employment type in Firm D, 1981, '86, '91

	1981	1986	1991
Full time	74	72	54
Part time	0	0	0
Temporary	0	0	0
Total	74	72	54

Source: primary research

not being replaced. This workforce may be viewed as stable since turnover is low due to high wages, full-time entry level starting at $18 and trades receiving $22 an hour, and good non-wage benefits. Furthermore, layoffs are rare. In times of economic slowdown unemployment is apportioned evenly throughout the production plant through a job sharing system operated by management. As the manager describes:

> "it is not certain kinds of people that get laid off. When you tell a worker, 'Okay you go home for three months' they never come back. To keep our job base secure and have the people with the knowledge here, we job share. It doesn't matter if you have been here for one year or thirty years, everybody takes a fair kick. In this system if there is going to be five weeks of layoffs everybody gets a week of it".

In this way, firm specific skills are kept within the firm, increasing functional flexibility. Long term investment in training is reduced and numerical flexibility is achieved without having to enroll and drop temporary employees.

As with the majority of remanufacturers, firm D is a non-union firm. Rather, firm D operates on what the manager termed "a family basis" where-by enrollment occurs via word of mouth through friends and family. The use of a family based union may encourage high productivity through peer pressure and may reduce costs in the enrollment of reliable workers. As the manager points out, "we are a pretty tight knit group, there aren't many people here who are not related to somebody. We have got brother-in-laws and friends of somebody's sister, so there is a lot of peer pressure on people who are coming in here. They won't even bring that person if they think there is a chance of there being a problem. Second, when they get here they get some help and understanding of how this company works and how the management systems work along with the production systems". The utilization of workers via a family basis may therefore hold many advantages in employee control and worker productivity. The issue of family based flexibly specialized firms in North American warrants greater attention as a comparison to existing research into family based firms or *artigianos* in the Third Italy (Goodman, 1989).

As a specialty subcontractor, firm D invests a significant amount of time in training its employees. According to the manager, for a production worker to operate without any

form of supervision requires two or three years training, with a tradesperson required to have at least five years experience and an appropriate ticket. This may reflect the high-value processes performed by the firm. With the majority of processes producing finished products (or at least finished components for manufacturers) and the average value of product fetching at least $1,000 a thousand board feet. there is a need for stringent quality control throughout the production process. Consequently, each production worker is required to posses a nearly full knowledge of the production system within the firm. Each production worker knows an average of 4 tasks (40% of total tasks on the production), with incremental increases awarded for increased ability, knowledge and enthusiasm. As the manager states, "Everybody can do a broad range of things...we make a crew list every week...the next week the same people might be on different machines working on different tasks because the order file is pertinent to that machine and there might not be an order file for that machine so we would move everybody". As such, the existence of multi-skills allows the firm to utilize employees most efficiently through organizing worker scheduling to best meet demand, whilst retaining quality control through experienced workers.

Firm D therefore displays functional flexibility though intensive on-the-job training in order to produce what the manager terms "a super crew", enabling high-quality process to be performed, whilst numerical flexibility is obtained through job sharing which keeps skills in-house rather than through the use of temporary workers.

The position of firm D within the production system may therefore be seen as a significant factor in determining the nature of labour relations and investment in the firm. As such firm D has increasingly concentrated upon the promotion of a stable, highly trained, multi-skilled workforce, working alongside highly specialized equipment in order to serve a variety of markets and provide specialty services to other remanufacturers.

Synthesis - Independent Remanufacturing Firm Strategies in a Flexible Production System

An investigation of the independent remanufacturing production system, through in-depth case studies of varying firms, provides a deeper understanding of the complexity and variation in industrial strategies, forms of emerging labour flexibility and technological investment. I would argue that the enterprise strategy pursued by the individual remanufacturing firm is in part a reflection of the position of the firm in the production system as a whole, and at the same time a reflection of the personal decisions and aspirations of the decision maker. For example, the strategy of firm B to contract out the high value processes to subcontractors is influenced by a management no-growth policy. As the manager stated, "we have a policy of no growth for the firm. By that I mean, any revenue that we make we tend to take as profit rather than invest in machinery". The lack of computers in firm C is not only a reflection of the standardized processes performed in the firm but is also influenced by the managers lack of computer knowledge, as noted "I don't feel computers are necessary, that is part of the reason. Another part of the reason is that I have never worked with computers. My wife feels we should have computers here but I feel it works quite well the way it is". Personal subjective decisions made by managers therefore have the potential to influence the industrial strategy and ultimately the role of the firm within the production system.

The nature of flexibility is a reflection of both technological investment and labour organization decisions within a firm occupying a specific position within the social division of labour. As such, it is possible to conceptualize a range of flexible options for firms in a production system (see Figure 4.8). It may be proposed that a flexible labour force may be attained through a variety of techniques, with the utility of functional, numerical and financial flexibility varying throughout the production system. Furthermore, investment in technology within each individual firm may also be a reflection of the position within the production system.

Figure 4.8 - Case study firm strategies

		Sophistication of flexible technology		
		low	medium	high
Form of labour flexibility	functional		Independent remanufacturer e.g. Firm A broad product mix and markets	Specialty subcontractor e.g. Firm D job sharing system to promote worker stability + skill
	numerical	Capacity subcontractor e.g. Firm C stores inventory for JIT system; low value products, job demarcation		
	financial	Contractor e.g. Firm B externalization of risk through subcontractors		

For example, operating in relative isolation, firm A invested in a broad range of flexible machinery in order to produce a wide range of products, and contracted out 15% of production to externalize uncertainty. Furthermore, firm A promoted a functionally flexible workforce to enable the production of a wide variety of high-value products. As a contractor with little capital invested in in-house production, firm B placed greater emphasis upon financial flexibility. In this way firm B minimizes the cost of production whilst reducing the risk of operating in an unpredictable economic environment. In contrast to firm A, by contracting out high value processes, firm B limited investment to cheap,

unsophisticated machinery designed for the initial breakdown stages of production. Whilst the extent of functional flexibility in firm C is greatly limited by its position within the production system, numerically flexible workers are used in order to cope with fluctuations in workload from contractors. Acting as a capacity subcontractor, firm C invested in old sawmill machinery in order to breakdown dimension lumber into various sizes and grades in relatively large batches. Furthermore, the use of firm C to process 'overflow' products and to store inventory promotes the flexibility of the production system as a whole. Finally, as a specialty subcontractor firm D chose to invest in specialized, high technology machinery for serving the highly specific requirements of contractors, whilst retaining product flexibility through multi-purpose machinery. This relatively high technology machinery is complemented by functionally flexible, highly skilled employees able to perform the variety of tasks and ensure value-added products of high quality. Thus the characteristics of independent remanufacturing firms are significantly influenced by the social division of labour within which they operate.

Chapter 5

The Remanufacturing Production System: the perspective of the large firm

Perhaps the most distinguishing characteristic of the 'thirty golden years' of Fordist production was the growth and industrial domination of the large firm. Within Fordism, industrial power became increasingly centralized in large, vertically integrated corporations typically serving mass markets through the utilization of mass production. This industrial strategy was further reflected in labour relations, which featured unionized workforces and collective bargaining indexing wages to productivity, which in turn was realized through investment in standardized machinery aimed at optimizing volume through economies of scale.

However, as was discussed in chapter two, the foundations upon which Fordist production was established began to crumble in the mid 1970's, and was both a cause and effect of the recession and subsequent restructuring of the early 1980's. The recession impacted heavily upon the large forest product manufacturers of British Columbia, reflected in the closure of facilities, employment loss and subsequent in-situ plant restructuring. This restructuring has emphasized the growing need to add more value to the forest resource, diversify into new markets and products, and increase industrial flexibility in order to cope with the new global economic climate. As such, some manufacturing plants underwent modernization in order to better service the Japanese market and, for the first time, a few large forest corporations of British Columbia emphasized the importance of remanufacturing lumber into high-value products .

The remanufacturing plants of large corporations are distinct from the independent remanufacturers studied in chapter 4. First, these plants are subsidiaries of large corporations which are multi-plant and multi-national enterprises with interests not only in remanufacturing but in primary manufacturing and pulp and paper production. Second,

large corporations are characterized by high levels of vertical integration which reduces the dependency upon the market place (that is, other enterprises), and as such reduces the appropriateness of a social division of labour. Third, the multi-divisional structure of the large corporation provides subsidiaries with resources from ancillary activities. These resources may include material supplies, such as lumber, finance, and product and market knowledge. Fourth, the availability of human as well as financial capital facilitates strategic planning and research and development within the large firm. The availability of these resources to independent remanufacturers is greatly reduced by their size, where owner-managers have relatively limited time and capital to invest in activities other than the day to day operation of the firm. Fifth, the majority of large corporations operated during the 'thirty golden years' of Fordism. Consequently, wood product manufacturing in these firms has been characterized by the mass production of standardized, low value commodities to serve the United States market. Furthermore, the production process has been dominated by a high level of unionization, increasing the cost of labour through escalating wage increases. Finally, the large corporations hold tenure. That is, they own cutting rights to a percentage of crown forest land in British Columbia. This decreases the uncertainty in supplying plants with fibre since each firm is able to calculate the volume of supplies and thus plan production in the medium to long term.

Furthermore, in contrast to independent remanufacturers who depend upon primary manufacturers and lumber brokers for supply, tenured large corporations have internalized supply through their own logging operations and thus have a steady flow of fibre. Holding tenure therefore reduces the uncertainty and unreliability of fibre supply and allows the large firms to plan what products to produce from a known fibre supply and what markets may be served. Thus, large firms may not require the flexibility of independent remanufacturers to deal with short term fluctuations in supply. It may be expected that these qualitative differences between the remanufacturing plants of large corporations and independent remanufacturers may be reflected through investment in machinery

(emphasizing longer production runs and more sophisticated technology) and the nature of labour organization (as a reflection of the unionized nature of large firms).

Using information gathered from annual reports and in-depth case study interviews this chapter examines the emergence of remanufacturing operations within two large Canadian forest product companies, focusing especially upon the nature and extent to which their remanufacturing operations in the Lower Mainland exemplify flexibility.

Case Studies

Firm E

The parent of Firm E is a Canadian owned multi-plant, integrated forest product company with interests in forestry, logging, building material and pulp and paper manufacture. As with the majority of large forest product companies, the parent of firm E underwent significant employment loss and restructuring as a result of the recession in the early 1980's. Total company employment fell from 7,100 to 5,600 in 1981 and 1986 respectively and in 1992 the parent of firm E employed 5,800 people. Between 1981-91 four mills were closed down and many underwent modernization.

In 1981 the parent of firm E concentrated its production on primary manufactured products, with over 80% of building materials sold to the United States market. The corporation performed no in-house remanufacturing, although the firm did contract out the production of remanufactured products (specifically clear sidings and interior panels) to a small subcontractor in the Lower Mainland. These products were then sold to the United States through the marketing division of the large corporation..

By 1986, the emergence of Pacific Rim markets and the instability of the U. S. construction industry encouraged the firm to consider diversifying away from lumber production and to place greater emphasis upon high value products. The resulting shift in focus was reflected in the modernization of sawmills. For example, the modernization of

one coastal sawmill was aimed specifically at adding value and diversifying markets. As the marketing manager for the parent firm notes:

> We are looking to do everything possible to improve the bottom line of our mills through value-added products. If a mill has the capability to upgrade a product to get a better return, we've got to go for it....45% of production from one of our coastal sawmills went to Japanese buyers in 1986, including dry kilned hemlock dimension lumber which sold at substantial premiums.

Furthermore, in 1986 the parent of firm E increased the use of subcontractors to remanufacture specialty products. As the same manager noted:

> More emphasis was placed upon producing clear and shop grades in all sizes and species, often sent on for further upgrading by remanufacturing plants. We are using custom remanufacturing mills to upgrade some of our lumber the way we want it, then turning around and selling that wood for a much better return.

Therefore, value-added initially emerged through the in-house production of a wider variety of dimension lumber within sawmills for more diverse markets, and the use of subcontractors to produce remanufactured products.

In 1987 the parent of firm E established a remanufacturing plant in Northern Washington, employing approximately 80 workers. In addition, the parent firm set up a research and development facility in the Lower Mainland to investigate the possibility of remanufacturing high-value specialty products. In 1991 the research and development facilities were transformed into a production plant for the manufacture of laminated products, mainly for export outside North America. The commencement of production at the Specialty Products Division brought the total remanufacturing employment within firm E in 1991 to 160 employees, although 136 of these workers were employed in Washington State. The Washington State plant is different to the Lower Mainland facility, producing a variety of low end remanufactured products from S-P-F, primarily for the United States construction market (80% of sales) and the Japanese market (20%). Moreover, in contrast to the male dominated workforce of the remanufacturing industry in British Columbia, 25% of production workers in the Washington States plant are female. The high proportion of women is an attempt on the part of the parent of firm E to reduce labour costs. As the

marketing manager for the parent of firm E notes, "generally women are paid less than men and I think that is applicable in the Washington State plant as well." Thus, the establishment of separate remanufacturing subsidiaries is an attempt to accomplish two production strategies: the production of low end commodities for the United States market using cheap labour in Washington State, and the production of high value specialty products for export markets where high labour costs in the Lower Mainland are less of a consideration. It is the Lower Mainland remanufacturing facility that provides the focus for the rest of this section.

Firm E Remanufacturing Plant

The remanufacturing plant was established by the parent firm in order to add more value to the lumber resource. As the specialty product marketing manager noted:

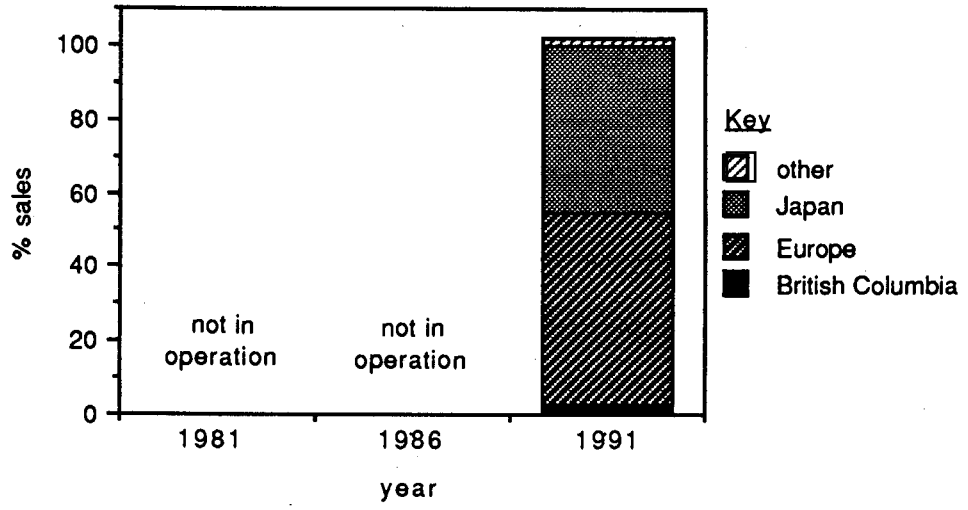
> "it was initially the big thing about adding value, there is no doubt about that, and I think the primary motivating factor was when the United States housing market slid and the company realized how captive we were to that. We recognized that we had better become more diverse and pull products out of the commodities mainstream and so there was a focus upon specialty products and remanufacturing".

As such the parent of firm E changed operations from a contractor of small quantities of remanufactured products and transferred production in-house through the establishment of a specialty products division.

The remanufacturing plant primarily utilizes hemlock (90%) to produce laminated products for the European and Japanese markets (see Figure 5.1). The plant produces a narrow range of products, specifically laminated and finger-jointed stock for windows, and laminated beams for construction. In producing these specialty products the plant services a niche market, and through obtaining certification in Europe and Japan is the only plant in North America to service these markets with specialized laminated products. As the production and sales coordinator of firm E notes, "it is a niche market because we produce the product that they are looking for, a specific product for a specific part of the global

market". In contrast to the broad product mix and fibre types utilized by independent remanufacturers in the Lower Mainland, firm E focuses upon a highly specialized product,

Figure 5.1 - Markets of Firm E Specialty Products Division, 1981, '86, '91



Source: primary research

requiring consistency of fibre supply and quality in order to satisfy consumer standards.

The remanufacturing plant is not contracted out by any other remanufacturers and it only performs specific processes appropriate for the production of the specialized product. Furthermore, contracting out work to local remanufacturers is rare due to the need for quality control and the highly specialized techniques used in production. As the production and sales coordinator of firm E points out, "we prefer to do it ourselves because we can control quality much better here from each machine center". In the eighteen months the plant has been in operation a subcontractor has been used on only one occasion. In this case a local capacity subcontractor was used to perform initial breakdown as the lumber dimensions were unsuitable for in-house processing. In contrast to the social division of labour utilized by independent remanufacturers, the processes performed by firm E are largely isolated from the local production system. As the production and sales coordinator

noted, "it is very internalized within the firm". This is due to the integrated nature of traditional production within the parent firm and is also a reflection of the different strategies pursued by small and large firms, with local remanufacturing firms unable to service the highly specific, technologically advanced demands served by the large firm. For example, in producing the specialty product, firm E not only follows the grading rules established by the industry but, as the production and sales coordinator pointed out, "we have our own grading rules and procedures for each machine center, and have specific procedures for tests in the lab as part of the certification". This use of in-house grading rules and procedures to satisfy specific requirements results in the exclusion of independent subcontractors from the production process of firm E. As such, remanufacturing in firm E is relatively isolated from the local production system, an isolation doubtless reinforced by the traditional lack of communication between large and small firms in the forest product industry of British Columbia.

As mentioned previously, the remanufacturing plant produces the laminated and finger-jointed product from hemlock, with the vast majority of fibre purchased from a company sawmill in close proximity to the plant. The plant is not tied to supplies from within the company. Rather, the plant is "treated as an economic entity, you have the freedom to get raw material from anywhere...because you are part of [Firm E] doesn't mean that you have any special treatment and that you can get all the raw materials that you need". This is an attempt by the parent firm both to ensure local cost control, and to increase the flexibility of the plant by placing it outside the confines of the vertically integrated internal production system. Despite this policy, all fibre supplies in 1992 came from company sawmills. However, this places a stress upon production due to the uncertainty of fibre supply. In comparison to sawmills within the company the remanufacturing plant consumes a relatively small amount of fibre each year, approximately one million board feet. Consequently, company sawmills do not cut to the specific dimensions required by the plant but supply the plant with a by-product of sawmill

production, supplies which are greatly dependent upon the products being produced in the sawmills. As the production and sales coordinator explains, "the sawmills cut for specific dimensions for their specific customers, especially if they are big sawmills they are serving different regions. This division is very small and it doesn't make a big difference to them...so they are not going to cut for us specifically the sizes that we are looking for." As such fibre supply is unstable and no formal contract exists between the company sawmills and the remanufacturing plant. As the production and sales coordinator notes, "We have no written agreement, just verbal. Supply depends upon what product they are running at the sawmill, if the market is strong in Germany or Japan and they are looking for a specific size of product then they just produce that order so sometimes the by-product is not available for us".

Consequently, in the short term at least, the remanufacturing plant may be caught in a supply trap. The remanufacturing plant is producing a specialty product that requires specific grades, moisture contents and dimensions, but in servicing a relatively small niche market, demand limits the supply of appropriate lumber. The remanufacturing plant is dedicated to a single product type which it produces in large volumes relative to the broad product mix and batch production of independent remanufacturers. As such, the plant lacks the flexibility to produce a variety of products in order to react to inconsistencies in fibre supply. This specialization in product mix potentially leaves firm E more vulnerable to fluctuations in market demand for primary products and changes in fibre quality. In the future firm E may attempt to resolve this problem by purchasing fibre from a variety of sources and through increased interaction with independent subcontractors in order to take advantage of the process flexibility present within the local remanufacturing industry. However, in 1992 there was no evidence of a decline in the vertically integrated structure of firm E.

Investment in the remanufacturing plant reflects the highly specialized nature of its product and the evident deficiencies in fibre supply. Since sawmills do not cut lumber to

the exact specifications required by the specialty product division the plant uses a band-saw, rip-saw and chop-saw in order to breakdown the lumber and produce the specific dimensions required. In manufacturing the specialty product the plant uses a laminating machine, a finger-jointer and a moulder. The plant uses computer assisted manufacturing on the laminating machine in order to obtain the precise pressure, temperature and thickness of glue to satisfy certification standards, while attaining high production volumes. As the coordinator pointed out, "we prefer to produce big volumes, not small ones. We are dedicated to one specialized product". However, the technology lies on a chip rather than in the hands of controllers and as such does not require in-depth training. As the production and sales coordinator notes:

> For laminating, the computer is fairly important, the parts are computerized [to improve measurement and accuracy], but there aren't consoles or keyboards, it is part of the computer, it is all in the program on the chip the manufacturers attached to the equipment. The operators just check it and set the gauge to the thickness required for that product, it doesn't require a massive amount of training or computer knowledge. It is not high skilled but medium skilled.

Production workers are trained to know the variety of settings for each product but lack the skills to perform trouble shooting duties if the machine should break down, a situation that has not yet occurred within the plant.

Table 5.1 - Full-time job categories by sex and year for firm E

	1991	
	M	F
administrative	4	0
clerical / support	0	1
trades people	1*	0
production line	18	0
other	0	0

Note
Production in firm E began in 1991. Employment figures are for December 31, 1991.

*this trades person is also involved in administration but has only been counted as trades in this table.

In 1991 the remanufacturing plant employed 23 full time workers (see Table 5.1). No part-time or temporary employees were employed, the plant running eight hour shifts with "no room for part-time, everybody works full-time". Although temporary workers are not officially used in the plant the instability of supply causes fluctuations in the demand for labour, with full-time workers hired in busy periods and laid-off when supply falls. As the manager explains, "we were trying to increase our crew but we didn't have enough raw material to run on a full-time basis so we had to go back to our original number of crew members (18 production line workers). Whenever we hire people it is on a full-time basis, not temporary, but sometimes the market is not good so we have to lay-off people". Temporary production workers become permanent after 45 days in comparison to office staff who become permanent after one month. After 45 days workers become union employees and are thus protected by IWA regulations.

Since the workers belong to the IWA, wages are relatively high compared to independent remanufacturers. The entry level wage is set at $17, grading starts at $19 and the one tradesman, a millwright, earns $24 an hour, each with a full union benefit package. However, despite the unionized status of the plant there is a low level of job demarcation and production workers are trained on-the-job for the variety of tasks, this training supplemented by classroom instruction on quality control. The necessity for labour flexibility in order to achieve quality control throughout production is reflected in the union - management collective agreement for the plant. Within the union local the need for flexibility was negotiated into a sub-agreement in 1991, allowing alternative shift scheduling for production flexibility, and less stringent job demarcation to promote functional flexibility. Accompanying this sub-agreement is a less confrontational attitude between labour and management. As a union representative relates:

> Flexibility is not a one way street, it only works if the workers are flexible and the management does not abuse that flexibility. At the plant the management and workers have such a good relationship the union hardly has to be there.

Some commentators (Berggren, 1989; Gertler, 1992) have argued that firms use functionally flexible workers as a method of intensification. In such a strategy the ability to deploy production workers to a variety of tasks reduces the number of full-time employees and eliminates the expense of employing separate graders to regulate product quality. However, there is little evidence that intensification is a key objective for management. As the union representative acknowledges:

> There is no threat of abuse or intensification because the management doesn't treat the workers like machines, there is a real feeling of mutual trust and respect.

Rather, the development of a functional flexibility benefits both management, through reduced manpower costs, and labour. Workers benefit through the introduction of variety into the job thereby reducing the monotony of repetitive tasks, and offers a challenge and increased job satisfaction through the mastering of a number of jobs. This emphasis is reflected in training. Upon entry into the plant the new worker is trained for the majority of jobs on the most basic machine center and from there is moved around the plant to different machine centers to obtain a broad knowledge of the variety of tasks in the plant. As the production and sales coordinator explains, "each machine center has different jobs and each worker will know the majority of them. They are trained on the job. Today for instance we have four people working on the moulder, so at the same time the operator is training somebody else as a back-up operator, and on the other end the grader is training the guy who works with him". Through this training system each worker is trained for a variety of tasks, such as in-house grading in order to carry out quality control inspection as the product is produced. Quality control is essential in order to meet certification standards and also reduces the amount of just-in-case inventory necessary for production. The plant operates on a month long inventory. In this system promotion is indexed in accordance with seniority and ability to perform the variety of tasks. This variety of tasks therefore introduces a degree of subjectivity into the promotion system, where the ability of workers to perform the variety of tasks is taken into account by management. As the production and

sales coordinator noted, "it is according to the ability of the people. if you train a back up operator for a machine centre and he does a very good job then eventually he could get promoted as operator. If you have somebody who doesn't perform properly what do you do? If he knows that he did his best then he will accept not getting the job and you move on to the next person".

Furthermore, the use of functionally flexible workers in the remanufacturing plant may represent a change in the power of organized labour. In contrast to the confrontational unions associated with Fordism, especially in the latter part of the thirty golden years, the attitude of the union seems conciliatory. As the production and sales coordinator noted, "they understand the problem, if they are not flexible then it doesn't work for anybody and you are looking at the closure of the plant, nobody wants to lose their job". Therefore it may be proposed that the move towards more flexible labour organization has been accompanied by more flexible unions. In Fordist production the skill of employees was limited by high job demarcation and seniority rules. In extreme cases, the role of the individual was reduced to a series of repetitive tasks along an assembly line. Thus, the limited power of the individual resulted in the need for organized representation. However, evidence suggests that changes have occurred in labour relations, encouraging, even necessitating, functional flexibility with low levels of job demarcation and a promotion system based upon the ability and merit of the individual. Consequently, job security has been replaced by employment security in a system where the aspirations of the individual worker may be met through hard work and training. As such, the strength of unions have been fragmented resulting in a more conciliatory and flexible attitude.

In summary, the nature and extent of flexibility within firm E may be viewed as significantly different from that of independent remanufacturers. First, the establishment of a small, specialty product division treated as an independent entity from the company lends evidence to the proposition that a move towards flexible specialization results in a move towards small, specialized subsidiaries of large firms in an attempt to service niche markets

in a more competitive production system. Second, the nature of production supports Sabel's view that a move towards flexible production in the large firm results in 'flexible mass production'. The mass production of a specialized, niche product may best be viewed as an attempt to diversify the product mix and become less dependent upon the United States construction industry. Third, the promotion of a functionally flexible workforce may be viewed as an attempt to assure quality control throughout the production process, whilst more efficiently deploying labour in order to decrease overall employment.

However, this strategy of flexible mass production may lack the flexibility to cope with the current instability and inconsistency of fibre supply due to an inability to produce a wide mix of products for diverse markets as the fibre quality necessitates. Furthermore, at the plant level, pursuing such a strategy adheres to the very inadequacies of Fordist production that it is attempting to overcome, that is, a lack of flexibility to react to market heterogeneity, uncertainty and dependence. This constraint may best be overcome by forging links with independent remanufacturers in an attempt to utilize the social division of labour that exists in the local production system. The creation of a partnership with local specialty subcontractors within which information can be shared may allow specialized processes to be developed externally in order to offer greater flexibility and internal efficiency. However, at the corporate level the establishment of a small subsidiary to serve European and Japanese demand with high value products represents a trend to diversification and increased flexibility.

Firm F

The parent of firm F is a large, multi-plant forest product company based in British Columbia. Traditionally this firm has focused upon forestry and the manufacture of primary forest products, producing commodity lumber from approximately 85% of its timber supply and releasing the balance to local remanufacturers. In 1989 a specialty

product division was set up within the firm to increase the focus upon value-added products.

This increased attention upon remanufacturing has emerged to serve several purposes. First, through remanufacturing the firm is able to focus more upon the end user, producing a wider product mix in order to service customer needs. Second, the parent of firm F has entered into remanufacturing in order to gain a greater margin on the timber processed. As the manager notes, "if you sell wood to a remanufacturer who in turn sells it to an agent who in turn sells it to the market then you are third down the line and you take whatever happens". Third, with the decrease in annual allowable cut, inconsistencies of secondary growth, price increases and environmental pressures focusing greater emphasis upon the value of the forest resource, the parent of firm F uses remanufacturing to gain an understanding of the true value of their timber supply. Finally, remanufacturing is viewed as decreasing the dependence upon commodity products for the construction industry, increasing the flexibility of the firm through the production of a wide product mix.

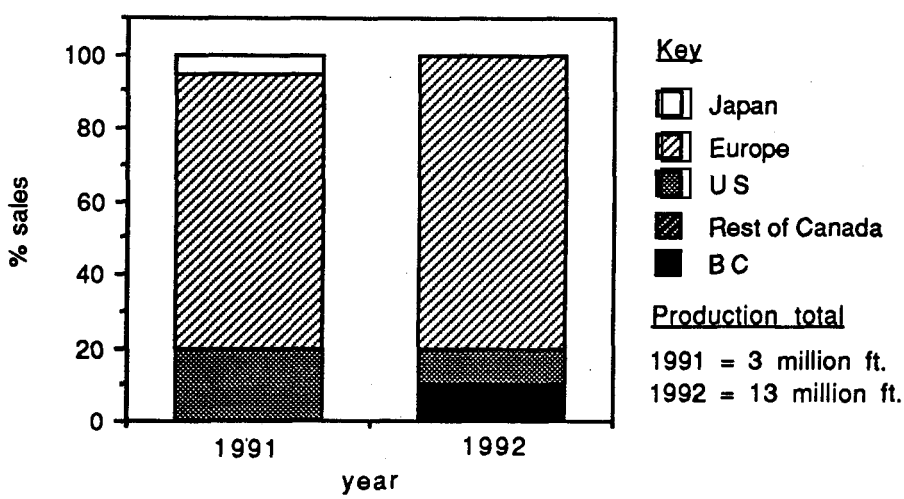
In contrast to the in-house strategy pursued by firm E, remanufacturing in firm F occurs externally through the use of local subcontractors. This strategy has resulted in a 20% decrease in the amount of fibre sold to local remanufacturers, replaced by an increase in contract work performed by local remanufacturers on fibre controlled by firm F. As the manager notes, "we are taking 13 million board feet and remanufacturing it ourselves but essentially it is not being taken away from the remanufacturers, it is being custom remanufactured. It is still supporting the same industry because we don't have our own facilities, we just control it ourselves". The use of local subcontractors to perform remanufacturing externally has increased dramatically over the last few years, with volume rising from 2.5 million in 1990 to an estimated 13 million in 1992.

In an attempt to diversify the markets served by the firm the vast majority of products from the specialty product division are sold to Europe as window and door components, (see figure 5.2) using hemlock (75%), Douglas Fir (10%) and S-P-F (5%).

However, over the short history of remanufacturing in the firm the amount of products sold within British Columbia has increased due to an emphasis upon the end use of secondary products through interacting with local remanufacturers and meeting local requirements. Through remanufacturing, firm F produces a wide variety of products from hemlock and as such chooses to use the social division of labour in the Lower Mainland rather than invest in technology. This strategy reflects both the perceived advantages of utilizing a social division of labour and an attempt to minimize the risk involved in investing capital in a relatively unknown and turbulent business. Consequently no investment into machinery has occurred within the specialty products division and labour is made up of four office workers, the division manager, production manager, sales and shipping, with the task of coordinating remanufacturing production through local remanufacturers.

As was expressed in studying the remanufacturing activities of firm E, inconsistency of fibre grade, fluctuations in price, and instability of supply pose a constraint to the manufacture of a standardized yet niche product of consistently high

Figure 5.2 - Markets of Firm F Remanufactured Products, 1991 and 1992



Source: primary research

quality *en masse*. As the manager of firm F notes:

> "The wood fibre can change, it can be course grain, it could be fine grain, it could have mineral streak, it could be in heavy knots. There is nothing static about wood so you have always got to adapt yourself to a variety of products to suit the wood pile. It is not as simple as saying, 'Every piece of wood is going to have a seven foot piece of clear cutting so you can make a door out of it'. Mother nature doesn't grow trees like that".

As a result, firm F uses the social division of labour in the Lower Mainland in order to produce a variety of products, from window components to sauna blanks, depending upon the grade and price of fibre and individual customer requirements. As the manager notes, "we felt that by working closer with some of the remanufacturers out there, by trying to develop partnerships, trying to understand the business a little better, getting a feel for what the true value of the wood is, we could probably make as much money as actually going out and investing a lot in plant and equipment". In this way firm F achieves what may be termed 'external flexibility' through the local production system without competing with experienced remanufacturers.

In utilizing the social division of labour in the local remanufacturing industry firm F uses five core firms on a regular basis, each subcontractor performing a specific tasks within the production system. As the production manager relates, "if you talk to any one remanufacturer he can do a lot of different things but he is probably very good at a limited number of things. So what we do is pick the remanufacturer that is the very best at doing what we want to do...you try to gear the product towards the right remanufacturer". As such, the firm uses a specific remanufacturer to perform kiln drying, a specific firm for laminating, and a specific firm for planing and moulding, each of these firms specialized in performing a specific task yet internally flexible enough to produce a variety of products. Four of the subcontractors used by firm F may be described as specialty subcontractors, used for specific processes in the manufacture of a product, with the other firm used as a capacity subcontractor to breakdown unsuitable lumber into sellable dimensions and grades. Depending upon market demand, fibre quality and price, firm F uses the internal

flexibility of these small remanufacturing firms to produce the required product, the final product having passed through three (or four if you count firm F) different firms. As the production manager describes, "we take some wood and we dry it at one firm, process it at another and chop some of the lower grade wood at yet another. So you can say that for half of all the products that we produce, which will represent 75% of the volume, there are three processes involved each one carried out at a different firm".

The use of local remanufacturers through what the firm describes as 'partnerships' provides many advantages to the large firm. First, in externalizing production the firm minimizes the risk involved in investing capital into a relatively unknown industry where local competition and experience exists. As the manager notes, "there is already more capacity out there so we would be fools to spend $4 million on a remanufacturing plant, especially with the provincial government direction now of supporting the secondary manufacturing industry. It is strategically better for us now to develop partnerships than to go out and invest in a big remanufacturing plant". Second, rather than focus upon the production of a narrow range of products through specialized machinery, as is the case in firm E, the utilization of the local production system allows the firm flexibility in production in order to cope with fluctuations and inconsistency in fibre supply. Third, as was emphasized in chapter four, the majority of small remanufacturers of the Lower Mainland serve niche markets and are very much customer driven. In establishing partnerships with these small firms knowledge is gained regarding the market, the complexities of the industry and the production processes involved in making a sellable product through the informal exchange of know-how. As the production manager explains, "we are learning about the markets, we are learning about how it is processed, we are learning what we need to do as a manufacturer to produce a piece of wood that is the right grade and size for that person". As such, the use of small firms may be thought of as part of a learning process through which the large firm may enter the remanufacturing industry, thereby reducing the barriers to entry.

In contrast to the remanufacturing strategy pursued by firm E, the development of partnerships with local remanufacturers is viewed by firm F as the best way forward for large firms in the remanufacturing industry, the firm having no plans to internalize remanufacturing production. As the production manager states, "there is probably a better chance of us joining an equity relationship with a remanufacturer, hooking on to what they understand in terms of marketing and processing experience and all the equipment that they have while we supply the wood pile". The development of a partnership between the large firm and a core number of small remanufacturers suggests the emergence of a relational contract. In using a social division of labour the production manager of firm F spends half of his time each week at subcontractors, explaining what processes are required and sharing information on in-house grading specifications and customer demands. As a result a relationship has developed between the large firm and the subcontractors, with the same five firms used in the production of various products due to the internal flexibility of the small firms and the time and information invested by the large firm. As the production manager pointed out, "we try not to swap and change remanufacturers. We want to stick with one guy who has done a good job for us because we have made a lot of investment in terms of management time to get to the stage where we can produce the quality product that we want". Furthermore, evidence suggests that where a core subcontractor is unable to perform a required process firm F would purchase machinery for one of the core firms in order to continue the relationship rather than drop the firm and move to a new subcontractor. As stated, "we might go to a remanufacturer and say, 'You have got four of the five pieces of equipment that I need to make the program work so we are going to buy you a finger-jointer and we want you to put the finger-jointer in and man it and put our wood through it but we still own that piece of equipment', that logically could happen, it makes sense". As yet this has not occurred, a reflection in part of the early stage of what the manager terms "an evolutionary process". The development of a long-term partnership between firm F and smaller, independently owned remanufacturers is similar to that

described by Asanuma (1988) and Patchell (1993) in the Japanese robotics industry, and as such may indicate the evolution of a more sophisticated relationship between large and small forest product firms.

The development of a long-term partnership however does not necessarily mean the formalization of a written contract. As has been mentioned, despite the importance of subcontracting between remanufacturers in the Lower Mainland written contracts are rare. Rather, business relationships are based upon trust, instinct and reputation, a point to which I shall return in the next chapter, underplaying the importance of written contracts. As the manager states, "contractually maybe, maybe not, close partnerships and those unwritten rules of doing business are just as strong as anything that is on paper". The maintenance of a close relationship is further emphasized by the location of the specialty products division within the Lower Mainland. As noted, "I spend fifty percent of my time during the week watching the wood being run and doing coordination activities outside the office so in terms of location...it is a matter of this division relocating at an area that is most central to our subcontractors. You don't really want to deal with a firm that is up in Vernon or Kamloops or Kelowna, you would prefer to deal with a firm that is close at hand because of the traveling time and the expense involved". The need for continual contact between contractor and subcontractor underscores the importance of agglomeration in a social division of labour in order to minimize transaction costs such as transportation and time, and lends evidence to the importance of locality in nurturing a sense of community, trust and cooperation between otherwise competitive firms.

Corporate Remanufacturing Strategies and the Search for Flexibility

In summary, the parent of firm F has pursued value-added through the production of a wide variety of products using the local production system. Firm F benefits from a learning process through interaction with small local producers, which limits the risk of entering a relatively unknown industry. Furthermore, through the utilization of a social

division of labour, the parent of firm F achieves flexibility whilst retaining control over fibre supply and thus industrial strategy. The strategy pursued by the parent of firm E may be seen as a contrast to that of the parent of firm F, a reflection of corporate structure and management decision making. The parent of firm E has pursued a strategy of producing high specialized value-added products for a specific niche market. Production occurs internally, utilizing the resource that exist in the vertically integrated corporation to perform research and development activities. As a result firm E manufactures a specialized product using sophisticated machinery. These contrasting strategies are further reflected in the utilization of labour, with the negotiation of functional flexibility into the IWA contract to allow the development of polyvalent skills in firm E, whist the absence of production workers in firm F reflects the use of local subcontractors to produce a broad product mix.

Chapter 6

The Lower Mainland: a Remanufacturing Industrial District?

The demise of Fordist production and the subsequent dawn of flexible production has been associated with the emergence of 'new industrial spaces' (Scott, 1988) and the re-agglomeration of industrial activity into industrial districts not unlike those described by Marshall at the turn of this century. Using case-study evidence it is the intention of this chapter to evaluate the extent to which the Lower Mainland represents a wood remanufacturing industrial district. First, it is necessary to understand what is meant by an 'industrial district'. In summarizing the characteristics of a flexibly specialized industrial district, Scott (1988) states that:

> producers who operate in disintegrated, multitask and uncertain economic environments are very likely to be tied to one another in high-cost linkage networks in which transaction costs are numerous, small in scale, unstandardized, and unstable over space and time...The net effect will be an intricate labyrinth of externalized transactions linking different producers, many of whom will coalesce in geographical space to form clusters and subclusters of agglomerated economic activity, (p.53-54).

For Scott, the key factor underlying an industrial district is the agglomeration of industrial activity in an effort by firms to minimize transaction costs. This operating cost incorporates the cost of operating in the market-place, comprising the cost of transporting materials between firms, the cost of sharing information with industrial peers, and the cost of selling a product in an uncertain economic environment. To these considerations, other commentators have added another important dimension underpinning the agglomeration of economic activity into an industrial district and that is the balance between the seemingly antagonistic forces of competition and cooperation (Lorenz, 1992; Dore, 1986). As Lorenz states:

> The case study literature has succeeded in cataloging the most prominent characteristics of industrial districts: a particular balance between cooperation and competition among the firms within them...Cooperation has two principal aspects. It takes the form of the provision of collective goods, notably training or education and research and development, but also medical care and unemployment

> insurance...through the auspices of some local institution. Cooperation also takes the form of adherence by producers to a set of norms of competition,...their being embedded within 'communities', and the high level of trust among producers within them, (p. 195-96).

In assessing the extent to which the Lower Mainland represents a remanufacturing industrial district this chapter is divided into two sections. The first section follows the lead of Scott (1988) by evaluating the significance of transaction costs in promoting the agglomeration of economic activity. The second section assesses the importance of the forces of competition and cooperation and explains how such antagonistic forces are resolved to promote efficiency within the production system. In so doing, the second section investigates the development of trust and a sense of community between otherwise competitive firms, and the associated role of local institutions.

Industrial Districts and Transaction Costs

The vertical disintegration of industrial activity from centralized large firms to independent small enterprises of itself need not necessitate spatial agglomeration of industrial activity, especially where these firms act independently of one another. However, in a social division of labour, firms are interdependent upon one another for material inputs, outputs and/or information. As Scott (1988) notes, "producers who operate in *disintegrated, multi-task and uncertain* economic environments are very likely to be tied to one another in *high-cost* linkage networks in which transaction costs are *numerous, small in scale, unstandardized,* and *unstable* over space and time" (p. 53, italics mine). According to Scott, the net result is the agglomeration of economic activity to produce an industrial district. This quote may be disaggregated and its various components 'tested' against the nature of remanufacturing in the Lower Mainland.

First, evidence from the previous chapters supports the argument that the remanufacturing industry in the Lower Mainland operates through a disintegrated and multi-task production system, expressed as a social division of labour. Manufacturing of a product occurs through the culmination of a series of processes undertaken by

independently owned enterprises in a vertically disintegrated production system. As the production manager of firm F explains, "for 75% of production volume, we take some wood and kiln dry it in one spot, process it in another, and chop some of the lower grade wood at another firm. So there are three processes involved, each one carried out at different firms". This quote clearly exemplifies the vertically disintegrated nature of remanufacturing, specific processes being performed by specialists within the local production system.

Second, operating as a remanufacturer in the Lower Mainland brings with it uncertainty, particularly in regards fibre supply. Independent remanufacturers do not hold tenure and as such are reliant upon the large, tenured primary manufacturers for lumber. With sawmills focusing upon the mass production of dimension lumber, the fibre requirements of remanufacturing firms have traditionally been ignored by large corporations. Remanufacturers consume relatively small volumes of fibre and, as a result, sawmills have viewed restructuring production in order to cater for a niche market as inefficient. Furthermore, due to the high degree of automation and continuity of production in sawmills, the opportunity to extract suitable lumber for remanufacturers during the production process is limited. Consequently, fibre supply for remanufacturers in the Lower Mainland has often been derived from the mistakes of sawmills or from falldown dimensions during production and thus dependent upon the products produced by sawmills. This lack of cooperation between sawmills and remanufacturers has created uncertainty within the local industry where firms are unsure about fibre supply and where production must be coordinated in accordance with the fibre received.

Third, with a reduction in the annual allowable cut, increased environmental concerns, and native land claims, the availability of fibre has become even more unstable. These pressures have greatly affected the coastal species of western red cedar. Furthermore, the quality of lumber has become unpredictable with the depletion of primary growth timber. Consequently, production from red cedar has become increasingly

unstable, resulting in the externalization of production to subcontractors, and a general trend within the industry towards lighter species such as spruce, pine and fir from interior mills.

Fourth, since remanufacturers are adding value in production, the value of material transactions is high. For example, the production manager of firm F stated, "you are trusting [a subcontractor] with a truck of clear grade wood, it could be worth $30,000 and you dump three trucks of wood there". On average, remanufactured lumber sold at a value of $1,000 per thousand board feet. However, this value varies throughout the production system: thus the highly specialized product manufactured by firm F is valued at $18,000 per thousand board feet, while the relatively low value lumber remanufactured by firm C is valued at $800 per thousand board feet. In comparison to lumber produced at a sawmill, which averaged approximately $350 per thousand board feet in 1992, these products are of high value. The transportation of these high value products from one firm to another promotes agglomeration due to the increased cost of transportation with distance and the risk of damage during long hauls. For example, when questioned about the prospect of relocating the specialty products division from the Lower Mainland to Washington State, the production coordinator for firm E stated, "I don't think it will help us because you can't conserve the product under transportation, just one mistake such as getting the lumber wet and you have a problem. Production will stay in the Lower Mainland because our suppliers are in this area". This stands in contrast to the Washington State location for firm E's low end, commodity product remanufacturing facility.

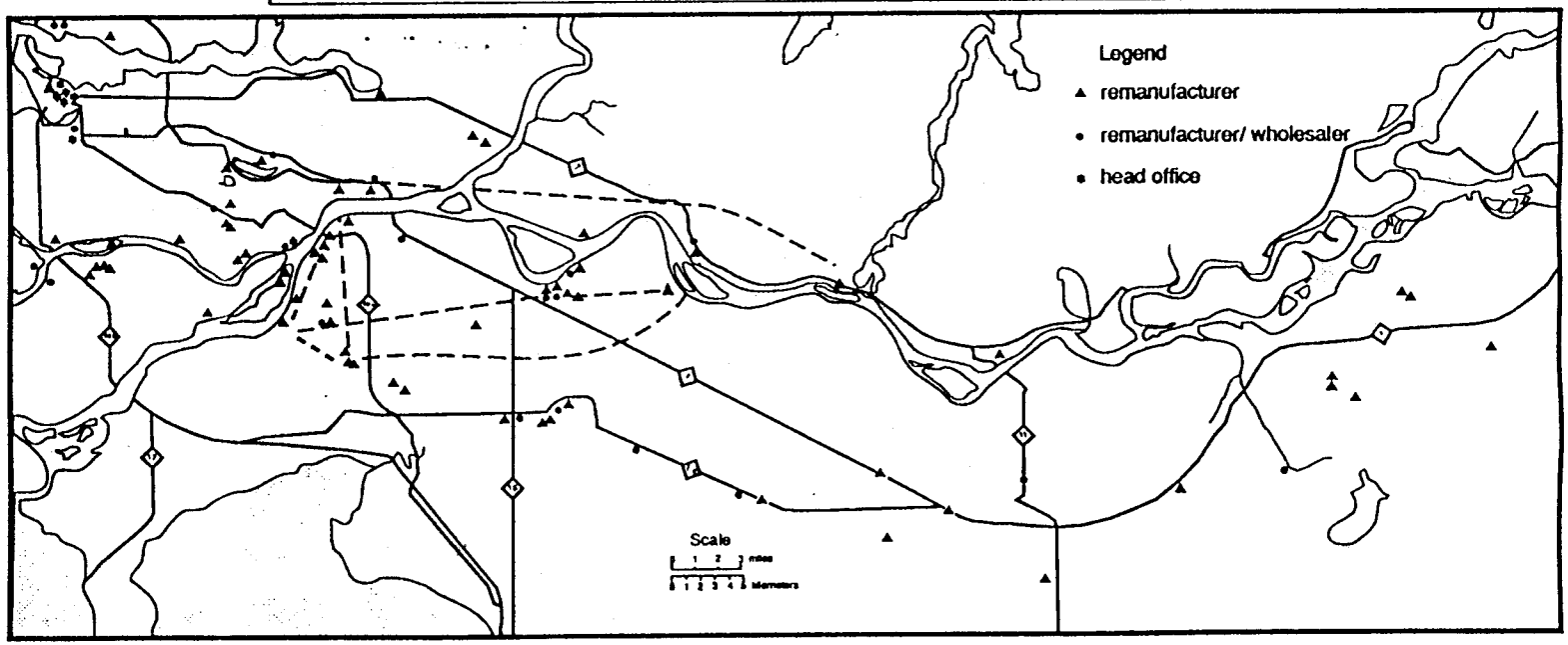
Fifth, transactions between remanufacturing firms are numerous. Within the social division of labour lumber is exchanged on a continual basis as part of the production process. Furthermore, with an overall reduction in inventory control, particularly by distributors, material transactions have become more numerous. As the manager of firm A notes, "the whole method of distribution is changing so much. we used to ship railroads of things and people used to keep a lot of inventory, now everything is moving to more of a

just-in-time type inventory, the pipelines have got a little thinner so now there is more of a constant flow of product".

Finally, transactions are small and unstandardized, a reflection of the niche markets served by remanufacturers. In contrast to the standardized dimension lumber produced by sawmills, remanufacturers serve the specific requirements of the consumer. This results in small, specialized, batch production. Furthermore, the need for specialized processes often results in the increased use of the social division of labour. For example, firm B contracts out high value processes to specialty subcontractors rather than invest in expensive equipment internally, equipment that may not be utilized after the customers order is complete.

Remanufacturing in the Lower Mainland fulfills Scott's description of an industry which may be expected to agglomerate into an industrial district. As described above, the remanufacturing industry exhibits vertical disintegration, economic uncertainty and supply instability, exchanges products of relatively high value, and transactions are numerous, small scale and unstandardized. It may therefore be expected that the remanufacturing industry in the Lower mainland would show signs of agglomeration in an attempt to minimize material and information transaction costs. Map 3.1 showed that at the provincial scale the Lower Mainland is by far the most important region for remanufacturing, containing 62% of all firms. Does clustering also exist within the lower Mainland? Map 6.1 indicates that remanufacturing activity is concentrated into clusters within the Lower Mainland itself. A third of all remanufacturing firms are located within a eight kilometer radius of each other along the Fraser River in the New Westminster, South Burnaby and North Surrey area. The second cluster of firms is to be found at the intersection of highway 1A and highway 15 in the Cloverdale area, the third cluster located along the Fraser river in the Fort Langley - Haney area. These clusters first highlight the importance of transportation routes and the location of initial lumber supplies, that is the various sawmills located along the Fraser river. Second, as the majority of these firms are

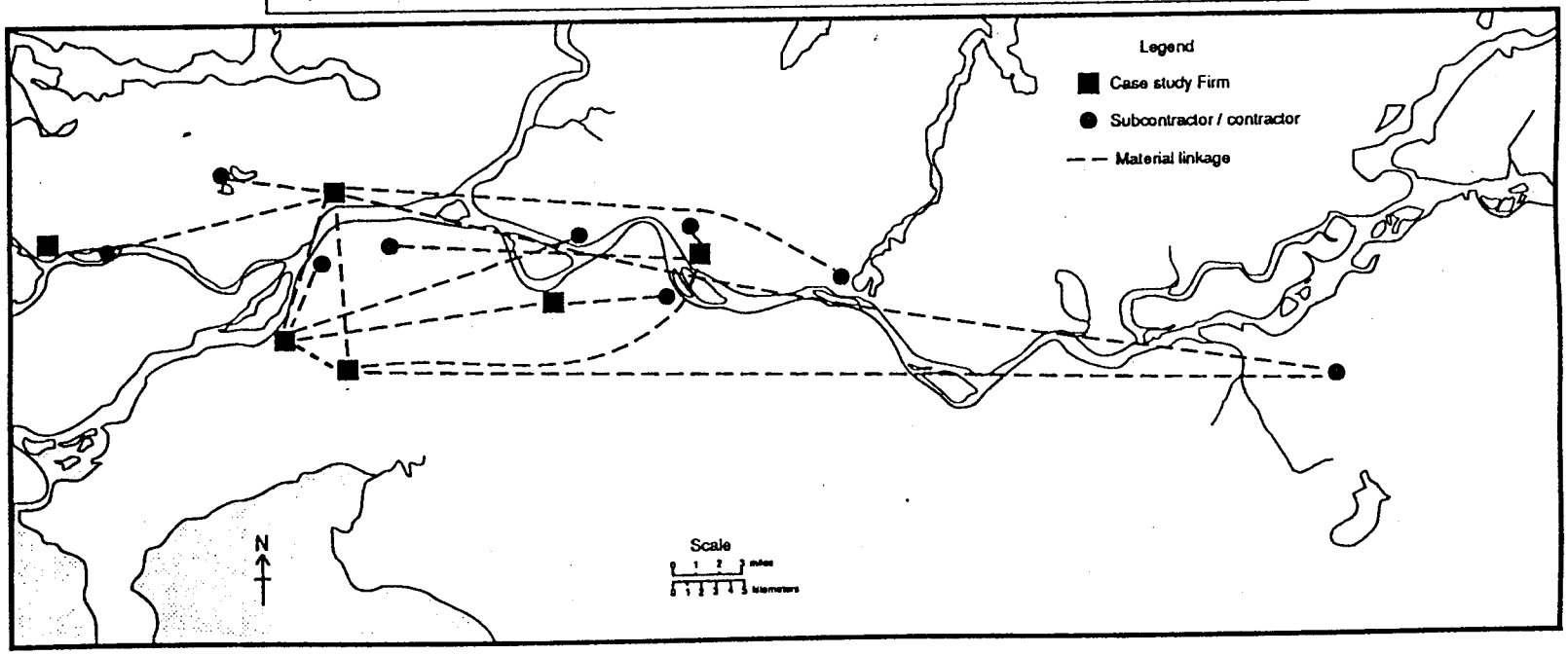
Map 6.1 - Distribution of Remanufacturing Firms in the Lower Mainland, 1989



owner-managed small firms an important locational factor is proximity to home. However, transportation and proximity to home were not the only factors deemed of locational significance. Rather, during in-depth interviews firms stressed the importance of locating in close proximity to the other remanufacturing firms to whom they contract work or perform subcontract work for within the social division of labour, in order to minimize the cost of transportation and in-person information exchange. Thus, evidence suggests that remanufacturers agglomerate together in an attempt to minimize transportation costs. As Scott and Kwok note in studying the printed circuit industry, "producers tend to converge locationally around points that are maximally accessible to their main customers" (Scott and Kwok, 1989, p. 409).

Furthermore, map 6.2 shows the case study firms and those firms with which they are linked through material inputs and outputs. Three observations may be made. First, the overall distance between each remanufacturing firm and its contractors or subcontractors is relatively short. For example, the average distance between Firm F and the subcontractors it employs is 9 kilometers, with Firms B and C both utilizing a subcontractor located less than one kilometer away. Overall, the average distance linking firm to firm was nineteen kilometers - and this figure is raised significantly by the presence of one firm located at the far east of the map in Sardis. With this firm excluded the average distance falls to fourteen kilometers. The firms may therefore be viewed as in close proximity to one another. Such close proximity may be argued to be a reflection of firms operating within the social division of labour attempting to minimize transportation costs, which increase with distance, while retaining the quality of service required to manufacture a product to the specific requirements of the customer. Evidence indicates that firms agglomerate note only to minimize the costs of transportation, but also to reduce the cost of in-person information sharing. Such in-person information sharing used to monitor product quality, reduce the risk of changing product design, and to solve production problems. As Firm F states, "The guys that I do business with, I'm probably there two or

Map 6.2 - Material linkages between case study remanufacturers and (sub)contractors in the Lower Mainland



three times a week. I am looking after quality control, making sure they have got the wood and they understand what they need to do with it...In terms of location it is not a matter of choosing them because they are closer or further away, it is a matter of us relocating at an area that is most central to them". There is therefore a need to minimize transportation costs and to reduce the cost of in-person information exchange in order to promote product quality and innovation. An attempt to minimize transaction costs results in an enterprise locating at a point, or perhaps more realistically, within an area which allows access to those firms which service the specialized requirements of the firm.

The second observation is the conspicuously long distance of a few of the transactions. This may be explained by the nature of the firm being subcontracted. The firm, located on the eastern edge of the Lower Mainland is a specialty subcontractor and specializes in performing highly specialized processes to small sized wood products. As Firm B noted:

> "that firm is the only one in the Lower Mainland and maybe in the Pacific Northwest that can do these small sizes in the way we want. They are so good at it that we don't go there very often. I have confidence in their ability. In regards to location they aren't exactly convenient,...so if they weren't doing the job well their location away from the mainstream would be a problem, it is a slightly higher truck haul to get the timber there".

Hence the highly specialized processes that the subcontractor performs outweigh the transaction costs involved in doing business. Such a finding suggests that highly specialized subcontractors are more likely to justify high transportation costs than capacity subcontractors where a certain level of process and product stability exists. Where the processes and products are continually changing, production through a social division of labour necessitates close proximity due to the need for personal interaction to clarify design specifications and share information on product development.

The existence of relatively long transportation distances between firms may also be the result of increasing land value in the more westerly, "mainstream" remanufacturing clusters, placing financial pressure upon remanufacturers to relocate further east. A recent

report has confirmed this, noting that the workforce of Greater Vancouver declined in 1993 for the first time in six years largely due to the rising cost of living. Consequently, "people can't afford to live here [in Vancouver] and taxes are so exorbitant that businesses can't afford to operate..[resulting in businesses moving]...to smaller regional centres where jobs are increasing, particularly in wood product manufacturing" (Brahman, 1993). Interviews support such a claim with many firms complaining of increasing rental expenses and residential pressure to relocate. As the manager of firm C stated, "the firm was originally located here because there was a site available and the price was right. Now this isn't the best site for the firm. If I could buy some property cheaply I would relocate to Mission, Abbotsford or Langley, more out of town. Taxes are getting very high around here and property is getting very valuable, a lot of plants have located out of town". This pressure may have contributed to a fragmentation of industrial clustering in recent years.

Third, when all five firms and their associated firms have been mapped, the pattern that emerges is not that of six focal points surrounded by subcontractors (as may be expected in an hierarchical system such as that used by Toyota). Rather, each firm exhibits an array of transactions which coincide with transactions from other local firms, suggesting the existence of 'cross-over subcontracting'. This cross-over subcontracting reflects the extent to which individual firms are utilized within the local production system. For example, Firm F employs five subcontractors to perform production process to its wood, three of these subcontractors are further contracted by other firms. The existence of these 'networks' of inter-firm linkages may serve at least two purposes. First, they reflect the degree to which a community exists within the local industry - few cross-over subcontracting relationships would indicate that each individual firm operates in isolation from the local industrial community. Second, where there exists a high level of networking one may expect a high level of information sharing and product - technological diffusion, as a reflection both of increased opportunity due to business contact, and of increased trust and mutual dependence. As such, the degree of networking within the local industry may

serve as an indication of how advanced the production system is and the extent to which the local industry operates within an industrial district.

In summary, evidence supports the rationale that agglomeration of firms into an industrial district is, at least in part, an attempt by managers to minimize the cost of operating in the market-place. In the vertically disintegrated remanufacturing production system, agglomeration is discernible as an attempt to minimize transportation costs, and to reduce the cost of sharing information with industrial peers. The existence of a sense of community may also be of significant importance in sustaining a social division of labour. However, in emphasizing the importance of transaction costs, Scott (1988) pays little attention to the importance of inter-firm cooperation and competition within an industrial district.

Competition, Cooperation and the Industrial District

For Lorenz (1992), cooperation between otherwise independently owned and competitive enterprises is "embedded within 'communities', and the high level of trust among producers within them" (p.196). In this sense not all agglomerations need to be communities. However, as will be shown, this sense of trust and community is evident within the local remanufacturing industry. On the other hand, many remanufacturers in the Lower Mainland operate opportunistically, purchasing lumber irregularly according to price and market demand in an attempt to increase cost competitiveness.

The existence of opportunism and trust between firms in the local production system seems paradoxical. However, upon closer inspection each serves an important purpose in promoting the efficiency of the industry through what may be termed 'competitive - cooperation'. As suggested by Lorenz (1992), the existence of cooperation and competition within an industrial production system is a prominent characteristic of an industrial district and may be integral to the success of inter-firm transactions, especially where product and technological innovation is the goal. Thus, in assessing the existence of

a remanufacturing industrial district in the Lower Mainland, it is necessary to evaluate the nature of competition, the extent of cooperation between firms, and how these interrelate in order to benefit the production system.

As has been mentioned on numerous occasions, rarely do transactions in the remanufacturing industry involve the production of a formal, written contract. Such a finding supports the view that "the use of the legalistic term 'contract' should not imply the use of comprehensive written agreements, for example the order is likely to be the only written agreement" (Lorenz, 1992, p. 372, footnotes). Every firm interviewed operated on a regular basis without the use of a formalized contract, purchasing and selling on a verbal agreement often over the telephone or by fax with a written order sent after the work is received. As the manager of Firm B states, "It is all done over the telephone and your word is your bond in this business. The paper work most time flows after the fact but sometimes you don't issue purchase orders at all". This lack of contracts serves to promote opportunism within the local industry. First, the lack of contracts reduces the level of commitment between the contractor and subcontractor in legal terms and allows subcontractors to be dropped in order to reduce costs, improve quality or change product mix. As the manager of firm B states when questioned about the informality of contracts:

> it goes back to the product mix. If the subcontractors that we are using now can't produce the products we require then we will find one that can. Or if another subcontractor can perform a process better now than a firm that has been doing it for the last five years then we may be prepared to make a change. There is nothing that is formal or written in stone, so we are flexible. We can make the moves anytime we want.

Second, the lack of formal contracts serves to increase product flexibility within the remanufacturing industry by reducing the formality and rigidity of process orders. As such, over a period of time work orders to subcontractors are able to evolve with market demands without the inconvenience of having to draw up a new agreement. This serves to increase production efficiency since changes in product design do not require the renegotiation of a formalized contract between contractor and subcontractor. Rather,

through in-person contact and information exchange new requirements can be introduced into the production process without costly disruption. As such, the informality of contracts allows for business opportunism. This opportunism increases product and process flexibility, the efficiency of product innovation and thereby increases competitiveness.

The lack of formalized contracts makes the business community vulnerable to exploitation from overly opportunistic firms. In a competitive environment, an unwillingness to compete within the production system results in business inefficiency and eventual failure. There is the possibility, given that the majority of business agreements are based upon trust, that an overly competitive firm may take advantage of the informal nature of business agreements. However, as the manager of Firm F notes, "there is an unwritten rule that if you don't trust the guy you don't do business with him, period, because you are trusting him with a truck of wood that could be worth $30,000 and you dump three trucks in there...trust is the name of the game, it is easy to lose big dollars in the business". In order to protect the industry from 'hyper-competition' there apparently exist unspoken 'norms of competition' by which each firm must comply. These norms of competition act as guidelines, determining what is acceptable competitive behaviour and what is unacceptable.

A norm of competition central to the remanufacturing industry is the importance of trust. Trust not only exposes firms to the risk of exploitation but also serves to regulate entry into the business community. As the manager of firm F stated, "trust is the name of the game, if you don't trust him you don't do business with him". Within the industry it is rare for remanufacturers to participate with firms they do not trust. It is therefore important for managers to be able to assess the trustworthiness of a potential client. Many business agreements are based upon industry reputation and a relationship built up over time. As a manager stated, "Our decision on whether to use an individual is based upon how efficient he is and whether he has a good reputation in the market. You have got to have a lot of trust in what he is doing". The ability for a firm to assess the trustworthiness of another

firm is of absolute importance to the contracting firm so as to ensure they are not exploited, and for the subcontractor in order to win orders. A breakdown in trust throughout the industry may well impact upon the efficiency of the social division of labour. As such there exist publications, for example the Lumberman's Red Book, and agencies such as the North American Wholesalers Lumber Association (NAWLA), which provide credit information on remanufacturers, sawmills and wholesalers to subscribers. These may serve to reduce the risk of participating with a relatively unknown customer.

Norms of competition are enforced through collective action against the non-compliant firm. Evidence suggests that mutual cooperation between firms and the sharing of information is used to sanction firms which break industry norms. As the manager of Firm B states:

> our industry is very truthful and honest, so if somebody is playing games and lying we like to let everybody in the industry know about it, especially if he has hurt you in some way. So you warn them...the goal is to get this guy out of here rather than have him go on and screw each one of us at a time. Let's stop him now. They don't last long because nobody gives them any business.

This backs up the suggestion by Lorenz that when firms within a community are threatened with the withdrawal of reciprocity, the firms are more likely to conform to the norms of competition based upon trust. As such trust and reputation may be viewed as informal, yet powerful forms of regulating competition and cooperation within the industrial district.

The existence of trust and reputation, upheld by the threat of community against firms whose behaviour is viewed as unacceptable, may be compounded by cultural differences across space. What may be viewed as acceptable business practice in one industrial district may be viewed as unacceptable in another. As such, in studying an industrial district it is important to recognize the uniqueness of place, of "how local history, culture, institutions, and industrial structure interact with global competitive forces to produce local development trajectories" (Gertler, 1992, p. 274). Local idiosyncrasies may hold the key to understanding why an industry exists in a local area and operates in a specific way.

Norms of competition not only serve to diminish exploitation by overly competitive firms but also promote a sense of community between firms for the benefit of the industry as a whole. Lorenz (1992) suggests that a strong sense of community within an industry promotes the extent of inter-firm cooperation. For example, studies of Japan (Dore, 1986) and the Emilia Romagne region of Italy (Piore and Sabel, 1984) have suggested that small firms within industrial districts cooperate in regards to product innovation, technology, even finance, in order to increase the efficiency and competitiveness of the industrial community. As such, a sense of community and a high the level of trust between firms increases the extent of cooperation between firms, which in turn increases the sense of community and trust.

Interviews of remanufacturing firms suggest the existence of a strong sense of community in the Lower Mainland. As the manager of firm B states, "the remanufacturing community, especially here in the Lower Mainland, is quite small in terms of people knowing each other, we all kind of know each other and most of us are friendly with each other. I guess there is a community here and that defines it to a degree". Further, the manager of firm F noted, "it is not a big community. It is a fairly small community in the sense that there are maybe 15 good sized remanufacturers out there". As such, in the day to day business of operating a remanufacturing firm, especially where the firm is involved in the social division of labour, managers come into contact with each other in a purely business setting, often spending time to clarify work orders and discuss points of mutual interest.

Furthermore, this sense of community is promoted in at least two ways. First, many managers and owners of remanufacturing firms interact through industry associations for annual and monthly meetings, Christmas dinners and seminar groups. Six of the seven firms interviewed belonged to at least one of these industry associations. It may be noted that firm C does not participate in these meetings, citing lack of time as a major reason for non-attendance. Furthermore, as a capacity subcontractor reactive to the demands of

contractors, information on marketing and innovation is of limited utility to firm C relative to comparatively proactive remanufacturers. Such associations serve as a focus around which managers may rub shoulders with customers and competitors, and through which issues of mutual interest and concern may be addressed, thereby strengthening the sense of community.

Second, a sense of community is promoted through more social settings. Three of the managers interviewed play golf with other remanufacturers several times a year and participate in industry golf tournaments. Furthermore, through the 'Who-Who Group', which organizes purely social functions, managers and office workers are able to interact socially with their industrial peers. Although such groups exists, it is unclear as to their significance in promoting a feeling of trust between firms. As a manager states, "the idea of trust and how it has developed and whether it is nurtured and maintained is simply a matter of reputation because it is not that big a group". Rather, these social gatherings may be more important in promoting information sharing in an informal setting rather than the generation of inter-firm trust.

This sense of community and trust is of great importance in promoting information sharing between firms. This is perhaps the most significant expression of cooperation between otherwise competitive firms. All the remanufacturing firms interviewed in the Lower Mainland, with the exception of Firms C and E, share information with other remanufacturers or wood product manufacturers. As mentioned above, firm C is reactive to the demands of contractors and performs no research or development. The firm therefore has little to offer other firms in regards innovative information. Firm E does not participate in the social division of labour and therefore has little contact and therefore opportunity to share information with other remanufacturing firms. The other five remanufacturing firms share information on an informal basis through everyday business contact and social - recreational interaction, with similarities evident in the type of information shared and withheld by firms.

Evidence suggests that there exists two broad categories of information, the first may be described as 'common information', and the second as 'strategic information', the prior being shared by firms in the Lower Mainland, the latter being withheld. Common information consists of information prevalent to the activities of each remanufacturing firm. First, managers most commonly speak of sharing information on the incorporation of machinery into production. As the manager of Firm D explained, "we have gone to see how machinery applications are put in work, we have got a problem , we want to make a change in our line or we are not clear in our thoughts, we will make a call and say, 'Hey can we come out and see what you are doing?'" The sharing of information about machinery benefits not only the individual firm but the community through the social division of labour. Second, firms share information on labour issues. As the manager of Firm B related, where conflicts over salaries and benefits exist other remanufacturing firms will be consulted in order to set an acceptable yet competitive level of pay. This lends evidence to the suggestion by Lorenz that firms within an industrial district may attempt to set salary norms in order to refrain from wage competition. Third, information is shared by remanufacturers in order to force unreliable and untrustworthy firms and customers out of the industry. As a manager notes, "we will share customer information, if somebody is giving you a bad time or if somebody is developing a tendency to be slow at paying". Information sharing by remanufacturers in the Lower Mainland may therefore be viewed as for the common good of the industry and in order to sustain the efficiency of the social division of labour.

Evidence suggests that remanufacturing firms in the Lower Mainland are secretive about what may be termed 'strategy information'. This information pertains to the business strategy pursued by the individual firm such as niche products produced, specialized production techniques used, volume of sales, and the customer base of the firm. As Firm D points out, "if it is something that is common, a commodity like dimension stocks then yes we share information because anybody can make it. Some of our little pattern works

that we are doing and niche customers that we service, we don't give out that information". Further, as Firm B notes:

> we don't tell each other about the specifics of our business, what we are doing and how we are doing it, because you might be telling the guy something that he doesn't know. If we have got a little niche here that I don't think they know about then I am not about to say 'I am doing this', because they will be doing it the next day if they can work it out. If he already knows it we will have open discussions about it as long as it wasn't perceived that it was going to do the company damage by creating competition that isn't already there.

In sharing information with other firms in the Lower Mainland remanufacturers balance the good of the business community with secrecy about individual firm strategy. Such a balance may be viewed as a reflection of both economic and cultural factors. The balance between information sharing and secrecy may be a reflection of North American socio-economic ideology. In contrast to the Japanese ideology of community prosperity, Anglo-American ideology may be viewed as promoting the freedom and prosperity of the individual as well as the community, and as such results in a degree of information hoarding, especially where uncertainty exists.

In summary, remanufacturing firms operate via competitive-cooperation. Competition is essential in order to maintain high quality products that are able to compete in the marketplace, while inter-firm cooperation is necessary in order to maintain trust, reputation and the structure of the social division of labour in the industrial district. The balance between these otherwise antagonistic forces is regulated by a set of norms of competition in the local industry. These norms encourage cooperation in the form of trustworthiness and information sharing, whilst discouraging excessive opportunism and competition through the threat of community action against 'misbehaving' firms. However, in comparison to industrial districts in Europe where cooperation is maintained in part through an 'economic safety net' (Lorenz, 1992), cooperation in the remanufacturing industry of the Lower Mainland is limited by the lack of 'leveling mechanisms' such as the availability of credit during downturns and guaranteed unemployment insurance for all laid off workers, especially the entrepreneurs themselves.

Despite the absence of an economic safety net in the Lower Mainland, a handful of industry associations exist with the goal of benefiting the remanufacturing industry through the promotion of community, cooperation, and the regulation of competition.

Industry Associations in the Remanufacturing Industry of the Lower Mainland

Upon documenting the existence of industrial districts in Italy (Brusco), France (Lorenz) and California (Saxenian) increasing attention has been paid to the role of industry associations in promoting inter-firm cooperation and community action. This section briefly outlines the role of three major industry associations active in the remanufacturing industry of the Lower Mainland, namely the Council of Forest Industries of British Columbia (COFI), the British Columbia Wood Specialties Group (BCWSG), and the Independent Lumber Remanufacturers' Association (ILRA).

Council of Forest Industries (COFI) -

In 1966 a handful of small associations representing the forest product industry of British Columbia amalgamated to form the Council of Forest Industries. Since that time the association has addressed a wide variety of concerns within the forest product industry through a multi-departmental structure and an annual budget of approximately $10 million. COFI represents not only the remanufacturing industry but the primary wood product industry, the pulp and paper industry, and plywood industry. COFI boasts a membership of 62 firms, the majority of these being large corporations, holding tenure cutting rights to provincial crown land. The two large corporations interviewed in this study (firm E and F) are both represented by COFI, as is the relatively small firm D. Despite the limited membership of small, independently owned remanufacturers, the service offered by COFI are available to all firms on a pay-for-service basis, a service which is widely used.

The mandate of COFI addresses four key thrusts: government policy, training and quality control, marketing, and education. The first two of these roles are cited as the most

significant by the local remanufacturing industry. In liaising with government, COFI has been a leading representative of the wood product industry of British Columbia in opposing countervailing duties imposed by the United States government on Canadian softwood lumber exports. In this regard COFI has served as a voice for the industry community on this issue, and in the opinion of the association, has been reasonably successful. COFI continues to represent local firms in lobbying government to produce a long term forestry strategy for British Columbia. Firms view such a strategy necessary to minimize the uncertainty of fibre supply and the antagonism that exists between various interest groups and the forest product community. Although such a long term strategy continues to be elusive COFI feels that progress has been made with the establishment of the Commission on Resources and Environment (CORE) to deal with land use issues.

In promoting training and quality in the local forest product industry COFI performs many roles. First, COFI conducts courses on grading, tallying and quality control for workers in order to improve the skill level in the local industry. Second, COFI sets standards by which local firms can operate, such as standardizing terms for lumber grade within the local community to ensure that what is ordered correlates to what is receive, thereby minimizing the risk involved in inter-firm transactions. Third, the association provides technical information pertaining to Japanese and European standards and certifies firms to Japanese Agricultural Standard (JAS) and Eurocodes, thereby increasing the credibility of B. C. wood products. Finally, COFI acts as a mediator between firms in resolving quality disputes within the province and overseas. As firm B related, "we had a re-inspection that was in Europe and COFI looked after it. They have a man in Europe who flew to Germany where the problem was. This is the way things are handled".

The Council of Forest Industries therefore benefits the local wood products industry by serving as a united voice to the government and in setting standards and resolving problems between firms. In this way COFI reduces the risk of participating in a

social division of labour by limiting the supply inconsistencies and uncertainty apparent where a broad range of in-house grades and standards exist.

British Columbia Wood Specialties Group (BCWSG) -

This BCWSG was established in 1989 to help the growth and development of British Columbia's specialty wood manufacturing sector. The association is funded both privately through the subscriptions of local businesses, and publicly through Industry, Science and Technology Canada and the B. C. Trade and Development Corporation. Membership is open to any British Columbia based firm involved in secondary manufacturing for $2,000 a year. In 1992 membership totaled 53 firms, 85% of these being relatively small, non-tenured, independently owned enterprises. Of the seven firms interviewed, five are members of the association. The mandate of the association is realized through two key thrusts, marketing, and training and education. Marketing by the association focuses upon the highlighting the variety of products produced by member firms through the medium of trade journals and trade shows, "letting the world know that British Columbia is more than just rough, raw sawn wood; that there is a semi-finished products industry here" (interview with general manager, BCWSG). Furthermore, the group undertakes market research and hosts international customers on behalf of member firms. In this way the group provides a service to the local industry which small firms may not be able to afford financially or in time.

The second role of the BCWSG is in training and education. As the manager states, "In British Columbia we don't have the training, that is something that the BCWSG is working on". Training occurs through seminars, providing tallying, grading and kilning courses, and through in-plant training by experts in the field. As the manager points out:

> The owner operator of a plant is so busy with the day to day business of running his plant, he doesn't have time to develop training programs for his employees. We come along and offer that training, we have thirty videos on various skills, we put on a week of seminars for industry managers, we have been having a finger-jointing expert going to different firms training workers.

In this way the association attempts to minimize the cost of marketing, advertising and training for the independent, small business.

Independent Lumber Remanufacturers' Association (ILRA) -

The ILRA was established in 1979 "as the voice of the industry", serving as a liaison between independent remanufacturers and government (ILRA Membership Directory). In 1992 the ILRA comprised 33 firms, with membership open to non-tenured, independent remanufacturers of British Columbia for $600 per annum. Three of the five independently owned remanufacturers interviewed are members of this association. In limiting membership the association may stand as the most significant representative of remanufacturers in the province, able to represent the small firm in issues antagonistic to the larger firms, such as provision of lumber supply. It was this issue that initially sparked the establishment of the association. However, in recent years the ILRA has focused upon opposing the United States countervailing duties imposed in 1986. The ILRA hired lawyers in Washington D. C. to represent the perspective of local firms, with moderate success according to the association, with certain items exempt from the duty.

The second objective of the ILRA is to encourage the coordination and development of skills in the local industry. In striving to fulfill this role, monthly seminars are scheduled in which guests speak on topics relevant to the local industry, such as coping with the countervailing duties and dealing with solid waste. Such seminars also serve as meeting places for managers to exchange ideas and discuss common problems. Evidence suggests that this role of encouraging informal information exchange may be the most significant contribution of the ILRA. As the manager of firm B states:

> it gives you an opportunity to discuss the market and things, obviously you are not giving away secrets about what you are doing or how you are doing it but you get a feel for whether you are in sync. with the rest of the industry....You can have some close heart to hearts with them, bringing up problems.

Further, as the manager of Firm A relates:

> this is a very 'people' business, it always has been, so personal relationships that you pick up in industry groups are clearly important...[furthermore]...the association is good for dealing with common problems, how do you deal with the government on such a thing? what is your benefit experience? There are loads of things you can share experience on.

Evidence suggests that information sharing in informal settings such as those provided by industry associations are significant in promoting a sense of trust and mutual respect between firms, thus benefiting the local industrial community by encouraging competitive - cooperation.

Industry Associations: benefit or bureaucracy ?

Interviews suggest that local remanufacturers utilize a number of these industry associations for a variety of reasons. Of all the case-study firms interviewed, only firm C (the capacity subcontractor) was not a member of an industry association, noting time constraints as the major reason for non-subscription. In all, a total of fifteen memberships were shared, not necessarily equally, between the remaining six firms. If membership is used as a measure, it would seem that local remanufacturers view these associations as making a significant contribution to the welfare of the industry. In evaluating the benefit of industry associations to the remanufacturing industry each firm was asked to assess the value of the associations to their business.

Firm A belongs to the BCWSG, ILRA, the North American Wholesale Lumber Association (for credit information) and the Western Red Cedar Association. For firm A, industry associations are clearly beneficial to the business and are used in a variety of ways. First, firm A uses these associations to build upon personal contacts made with other remanufacturers in day to day business. The community is small and remanufacturers know each other through business contact; however for firm A industry associations offer a setting in which relationships can be strengthened. As the manager explains, "it is not altruistic or anything. This is a very people business so personal relationships are clearly important because they help your buying and selling". Second,

firm A uses the associations for information sharing with other firms in order to solve common problems. As the manager notes, "a lot of these associations are good for dealing with common problems, how do you deal with the government? What is your benefit package? There are loads of things you can share experience on".

Firm B belongs to the BCWSG, the ILRA, and the North American Wholesale Lumber Association (NAWLA). Firm B joined the BCWSG in order to take advantage of the marketing services offered. However, the firm is not satisfied and may withdraw its membership. As the manager stated, "The BCWSG is supposed to be a marketing group but we are wondering about its effectiveness". Firm B uses the ILRA as a lobbying group, especially against the imposition of tariffs on softwood lumber exports. Firm B uses the North American Wholesale Lumber Association for three purposes. First, the association supplies firm B with credit information. As the manager explains, "they have very good credit information, it is based upon other members reports and it is quick. If we find that one of our customers has been reported then we take a step back, check we are being paid what is owed us and maybe cut back on sales to the firm". In this way the risk of doing business with a relatively unknown customer is reduced, especially where no formal contract exists. Second, firm B uses the NAWLA to increase the profile of the firm within the industry. As the manager states, "the NAWLA is fairly prestigious, we were anxious to get involved in that because it gives you an aura of legitimacy". Finally, firm C uses the association for personal contacts with other wood product manufacturers, "they have a regional meeting once a year and I don't think we have ever missed one. It is a big social function and they have guest speakers. It is an opportunity to rub shoulders with suppliers, competitors and customers. It also gives you an opportunity to discuss the market...you get a feel for whether you are in sinc. with the rest of the industry". Although firm B does not belong to COFI the manager emphasized the importance of the association in regulating grading standards, noting that the standardization of grades within the industry reduced the uncertainty of ordering from relatively unknown firms.

Furthermore, the manager stressed the importance of COFI in acting as an arbitrator between firms when disagreement about product quality emerges. By acting as a regulatory body, COFI reduces the risk of operating in a social division of labour where firms often rely upon the quality of independently owned and otherwise competitive firms for the production of a finished product.

Firm C is not a member of any industry associations, stating "I should be a member of the BCWSG but I'm not. I have never joined, I have thought about it but never got around to doing it. It wouldn't hurt because I would get a little more information as to what is going on in the market." This lack of involvement also reduces the level of contact between firm C and managers of other remanufacturing firms. As the manager states, "I have very little contact with remanufacturing firms. I am not saying I have no contact with them but I have very little contact with them". Despite the lack of interaction with industry associations, the manager of firm C suggested ways in which associations could become more attractive, emphasizing the need for a remanufacturing employee listing upon which skilled workers could register and employees could draw the skilled employees required. None of the industry associations assist in employee enrollment. As the manager of firm C stated, "we need somewhere where people that are unemployed are registered so you can go and hire employees...Now you have to advertise what you need". Further, as the manager of firm D notes, "When you tell a worker, 'Okay you go home for three months' they never come back". Consequently, many firms invest in training workers, then in poor economic times are forced to lay them off and the workers 'disappear', as a result firms lose their investment. The manager of firm C suggested that the supply of an employee listing would increase the benefit of industry associations. Furthermore, such a system would serve as a safety net for employees by speeding up the enrollment process and save firms time and money in continually training a transient workforce, acting as a 'social safety net' in the industrial district (Lorenz, 1992).

Firm D is a member of the Council of Forest Industries of British Columbia. The manager views membership as beneficial in terms of marketing for red cedar. As the manager states, "We belong to COFI and rely upon their marketing programs. They are not marketing specific products for our company, rather they market red cedar as an outdoor decking product. This marketing is supplemented by product specific marketing carried out by firm D itself. As the manager notes, "basically it is ourselves visiting our customer base, seeing what they need, because all the time we are not producing a commodities product but niche products for the specific demands of the customer". When questioned about the marketing and training offered by other associations the manager expressed dissatisfaction. As the manager explained, "we worked with some of those groups early on and for the amount of dues that were required we never thought that we got our moneys worth, so now we do a lot on our own". Thus firm D emphasizes marketing and training internally rather than through the use of industry associations.

Although both firm E and F belong the BCWSG and COFI, and firm F is an associate member of the ILRA, the use of these associations is limited. First, these firms belong to large corporations which hold tenure, thus many of the issues and problems of independent remanufacturers addressed by the associations are of minimal significance to these plants. Second, through the multi-divisional structure of the corporations, marketing, innovation and training primarily occurs in-house. The availability of both human and financial resources makes it easier for the large corporations to invest time in activities other than day to day production. Evidence suggests that the membership of firm E and F is as much for political and industry relations purposes as for the benefits offered in the mandate of the associations.

In contrast to the industrial districts of Europe documented by Lorenz (1992) and Brusco (1989) the remanufacturing industrial district of the Lower Mainland lacks a regulatory agency to coordinate joint ventures between firms. This is largely a reflection of the business ideology in Anglo-American culture. Remanufacturers strongly believe in free

enterprise and the free market and consequently frown upon the intervention of any regulatory body which attempts to disrupt the market system in the long term. However, the number of joint ventures in the remanufacturing industry remains limited, despite the feeling of trust between firms. Most prevalent are short term logging agreements between independent remanufacturers and logging/sawmill companies in order to secure a reliable source of fibre. Both firm A and F stated that establishing a partnership with another wood product firm could make business sense, yet presently no long term partnerships have been established. The lack of such partnerships may weaken the potency of the industrial district, yet it is unclear how such ventures can be encouraged without explicit government interference, something remanufacturers in general denounce.

In summary, a number of observations may be made. First, industry associations enjoy a high level of membership, with representation from firms throughout the local production system. Second, despite the emphasis by certain associations (such as the BCWSG and the ILRA) upon training and education, not one of the firms interviewed cited training as a key benefit of the associations. Third, evidence suggests that firms use associations for a limited number of reasons, not least as meeting places through which management can share ideas, discuss common problems and strengthen the feeling of trust within the community. Finally, industry associations have the ability to promote the efficiency of the social division of labour by regulating quality, setting industry wide standards, and minimizing the risk of investment, innovation and partnerships by creating a social safety-net. This role of industry associations is limited within the remanufacturing industry of the Lower Mainland and may limit the rate of innovation and inter-firm partnerships in the future.

Conclusion

Case study evidence supports the view that the Lower Mainland represents an industrial district for the remanufacturing industry. Industrial activity operates through a vertically

disintegrated production system where firms agglomerate in order to minimize transaction costs. These transaction costs comprise the cost of transportation and the cost of inter-firm information exchange. However, the vision presented by Scott (1988) of an industrial district falls short since it does not take into account the importance of trust, community and the importance of place within the industry. These factors are of extreme importance when attempting to understand the paradox between competition and cooperation that exists in an industrial district.

Chapter 7

Conclusion

The aim of this concluding chapter is to respond to the research question set out in chapter one, that is, 'In what sense does the remanufacturing industry of British Columbia exhibit flexible specialization?' This is achieved through the synthesis of the results presented in the previous four chapters, focusing specifically upon the nature of labour, technological and industrial organization. Finally, the chapter discusses the implications of the research evidence, highlights issues that have been raised, and suggests directions for future research in order to answer some new or unresolved questions.

Flexible Specialization in the Remanufacturing Industry of British Columbia?

The remanufacturing industry of British Columbia, and specifically within the Lower Mainland, exhibits flexible specialization. The majority of small, independent remanufacturers attain flexibility through various forms of labour organization, utilization of unsophisticated technologies, and exploitation of a social division of labour. Conversely, the restructuring of traditionally fordist, tenured forest product firms introduces conspicuously different production strategies within remanufacturing in an attempt to achieve product and market flexibility. At least two forms of production strategies can be identified. The first of these emphasizes the low volume production of customized high quality-competitive products. All independent remanufacturers interviewed, plus case-study firm F, pursue this competitive strategy. Through a community based form of industrial organization, otherwise independently owned firms are linked through contractor - subcontractor transactions. Conversely, firm E pursues a strategy emphasizing the high volume production of customized quality-competitive products. However, within both forms of flexible specialization, the nature of labour and

technological flexibility varies greatly. The nature and role of this flexibility within the production system merits greater attention.

Flexible labour -

As a component of a traditionally fordist forest product industry, the remanufacturing industry of British Columbia represents a movement away from the labour rigidities imposed by high levels of unionization and job demarcation. The near absence of unions within the remanufacturing industry, especially in independent remanufacturing firms, has been accompanied by increased flexibility in the designation of workers throughout the production processes through the auspices of functional, numerical and financial flexibility. The nature of labour flexibility is a reflection of an individual firm's position within the production system in which it operates. For example, as a contractor, firm B externalizes the use of skilled labour by contracting out high value-adding processes to specialty subcontractors, whilst performing initial breakdown tasks in-house using low paid, numerically flexible labour. By contrast, operating at the high value end of the production system, specialty subcontractors such as firm D emphasize the development of a functionally flexible workforce. The development of a broad knowledge and involvement in production serves to ensure product quality, with worker turnover minimized through high wages and a job sharing system. Labour organization within capacity subcontractors emphasizes numerical flexibility, with the utilization of temporary workers allowing the size of the labour force to accommodate fluctuations in demand from contractors. Thus, the number of temporary workers rises during periods of high demand, such as the end of a business cycle, and later declines due to a lack of contract work. The use of numerically flexible capacity subcontractors allows contracting firms to externalize the fluctuations in production which would otherwise negatively affect the stability of employment within firms at the high value-adding end of the production system.

Flexible technology -

In contrast to the findings of previous research into flexibly specialized production systems, the use of 'flexible technologies' such as computer aided design and manufacturing (CAD/CAM) systems within the remanufacturing industry of the Lower Mainland is minimal. The majority of remanufacturers employ unsophisticated, multi-purpose machinery, with product flexibility attained through varying the combination of machines used. As such, the most common forms of machinery are green (sorting) chains, rip, chop and re-saws, and planers. The use of multi-purpose machinery permits the manufacture of a diverse range of products whilst limiting the initial cost of investing in expensive computer assisted manufacturing systems. Furthermore, rather than invest in a multitude of different machines to provide the capability of producing a diverse range of products in-house, remanufacturers specialize in two or three processes and contract out the remaining stages of production to subcontractors. The contracting out of processes to subcontractors serves to increase overall efficiency since each firm is able to attain internal economies of scale for a particular stage of production, whilst it externalizes the risk of investing in fixed capital in an uncertain economic environment. Thus, the nature of investment within the individual remanufacturing firm is a reflection of its position within the production system. Firms carrying out the majority of production in-house invest in a broader range of machinery so as to manufacture a broad range of products, as exemplified by firm A. Contractors who contract out the high value-adding stages of production invest in basic machinery for the initial stages of production, as exemplified by firm B. Investment by capacity subcontractors focuses upon a limited array of machinery dedicated to performing standardized processes in relatively large volumes, as exemplified by firm C. Specialty subcontractors and manufacturers at the high value-adding end of the production system may be expected to invest in relatively more sophisticated machinery in an attempt to assure product and process quality. Furthermore, being contracted out for specific high-value process, specialty subcontractors are able to invest in relatively expensive machinery

due to the demand from local contractors and the ability to charge a high price for the specific process performed. As a subsidiary of a large, tenured firm with relatively large financial resources, firm E utilizes the most sophisticated technology of all remanufacturers interviewed in producing a high value-added product in high volumes. Thus, firm E utilizes a computer assisted manufacturing system so as to ensure product quality in order to satisfy international quality standards, a reflection of the more ambitious strategy pursued by the large corporation. Evidence therefore supports the suggestion by Kelley and Brooks (1989) that the utility of sophisticated flexible technologies to small firms is constrained by financial and scale constraints, and that such technologies are more applicable to firms pursuing a strategy of flexible mass production.

The Production System -

The remanufacturing production system of the Lower Mainland of British Columbia may be viewed as flexibly specialized. Flexibility is achieved both internally through labour and technological organization, and externally through the social division of labour. However, whilst attaining flexibility the individual firm retains process specialization, making it an important component of the local production system. The use of in-depth case-studies revealed variations in the nature of flexibility throughout the production system, whilst simultaneously highlighting the specialization of each firm. The combination of labour - technological flexibility and process specialization results in a variety of 'pathways to flexibility' within the production system.

The contracting out of production to subcontractors seems largely an attempt to externalize the risk of operating in an uncertain environment. For example, remanufacturers have increasingly used subcontractors to process red cedar for the United States market, troubled by the rising cost and inconsistency of the fibre and tariffs on softwood lumber exports south of the border, whilst the contractors increasingly focus attention upon light woods for Japanese and European demands. Evidence suggests that

contracting out results in the limited investment of fixed capital for production in-house, especially where high value-adding processes are contracted out, with an emphasis upon the financial flexibility of the labour force.

The internal flexibility of the capacity subcontractor is limited by its position within the production system. Evidence suggests that capacity subcontractors are largely reactive to the demands of contractors. Investment is focused upon standardized, task dedicated machinery for the production of low-value lumber in large batches, with labour organization emphasizing numerical flexibility. As exemplified by firm C, the capacity subcontractor is often used to perform processes deemed unfavourable by contractors, such as the remanufacturing of red cedar products for the United States. Despite the reactive and precarious existence of the capacity subcontractor, the firm serves an important role in the flexibly specialized production system, allowing firms at the consumer end to concentrate upon the more profitable products and markets, and acting as a buffer to provide employment stability in contracting firms during fluctuations in the business cycle.

As a specialty subcontractor, firm D attains flexibility through a functionally flexible workforce, emphasizing worker responsibility and continuous training to ensure product quality. In an attempt to reap a return on the capital and time invested in labour training, firm D provides worker benefits, a 'family based union' to promote employee efficiency, and a job sharing system to reduce turnover. Evidence suggests that within a community based production system the specialty subcontractors have the greatest opportunity to invest in sophisticated machinery, firm D being the only independent remanufacturer to invest in computer assisted manufacture in the form of computerized dry kilns. Such investment promotes product quality and allows drying to the highly specific margins required by the customer.

The pathway to flexibility pursued by the large, tenured corporations are distinctive from independent remanufacturers. Rather than achieving product flexibility through the remanufacture of a variety of products, firm E focuses upon only one product of high

value, namely laminated window and door stock for the Japanese and European market. In remanufacturing this product firm E has invested in sophisticated computer assisted manufacturing an order to meet the stringent quality standards required by international customers whilst retaining high volume production. At the level of the parent firm such a strategy represents a move towards a more diverse product mix of higher value for offshore markets. At the level of the plant, production focuses upon a narrow product mix, produced in relatively high volumes. Consequently, remanufacturing in firm E represents a high volume, customized-quality competitive production strategy, namely flexible mass production.

In contrast to the other remanufacturers interviewed firm E does not participate in the social division of labour, opting to retain production in-house through the internal division of labour offered by a functionally flexible workforce and sophisticated flexible technologies. Functional flexibility within firm E has been attained despite the presence of a union. The formulation of a sub-agreement to the union-management contract has allowed greater flexibility in the apportioning of labour due to a reduction in job demarcation rules. The existence of a sub-agreement represents a more conciliatory attitude by the union. Evidence suggests that the investment in computer assisted manufacturing does not necessarily result in increased worker responsibility through 'informating'. As is exemplified by firm E, sophisticated technology often isolates the worker from the decision making and manufacturing process. Workers are used to set up the job before running and perform quality control on completion but due to the inaccessibility of the mechanics of production (stored in a micro-chip rather than human skills) are unable to participate in the manufacturing processes.

The pathway to flexibility pursued by firm F is in direct contrast to that of firm E. Rather than utilizing an internal division of labour, firm F exploits the external division of labour in the local area by contracting out all remanufacturing processes. In this way firm F achieves flexibility though switching subcontractors to conform with demand, whilst

avoiding the risk associated with investing in machinery and labour in a relatively unknown industry. This emphasis upon contracting out rather than in-house production is most significant in serving as a learning process for the large firm, the externalization of risk reducing the barriers to entering the remanufacturing industry, while simultaneously through association with experienced independent remanufacturers firm F gains an understanding of the industry.

Through the combination of flexible forms of labour, technological and industrial organization firms are able to achieve flexibility in a variety of different forms.

The Industrial District -

The Lower Mainland of British Columbia may be viewed as a remanufacturing industrial district. Evidence suggests that remanufacturing firms agglomerate into clusters, connected by material and information linkages in an attempt to minimize transaction costs. Furthermore, the proximity between remanufacturers and the prevalence of inter-firm linkages is a reflection of the high level of trust and cooperation between otherwise independent and competitive firms. The role of industry associations in the industrial district remains unclear. Evidence suggests that remanufacturers rarely utilize the associations in accordance with their mandate, for purposes such as marketing and training, opting to use the associations as meeting places for informal information exchange and as a regulatory agency in times of dispute. It may be this role that creates the greatest benefit in the industrial district, promoting a sense of community and inter-dependence between firms.

Issues Raised and Future Research Questions

This research has revealed the nature of flexibility within the remanufacturing industry of British Columbia. However, in a work such as this it is impossible to address every relevant issue and as such the certain issues remain unaddressed. Furthermore, with the

answering on certain questions new questions and implications are raised. This section draws attention to some of the issues which require further investigation, many of these relating to the nature of labour, technological and industrial organization, others to broader policy implications.

First, it is unclear as to the applicability of sophisticated flexible technologies in industries dominated by small firms. Evidence suggests that the use of such technology is limited within the remanufacturing industry of the Lower Mainland. However, to what extent this is a reflection of the uncertainty and instability within the industry rather than the nature of flexible specialization within a community based industry is unclear.

Second, research into the restructuring of the role of labour in the primary manufacturing wood products sector indicates an increase in the skill requirements of workers. However, little evidence exists to suggest an increase in the importance of informating skills in the remanufacturing industry to enable workers to interact with computer assisted manufacturing. Further research is required to clarify the nature of skills required within a community based industry.

Finally, theoretical classifications are overly simplistic when attempting to classify firm production strategies in this period of flexible specialization. The classification of high and low volume producers allows for much debate when attempting to classify flexibly specialized firms. The utilization of flexible technologies in predominantly large firms has allowed batch production. For example, in the context of the remanufacturing industry, in producing a limited product range firm E may be viewed as a high volume producer. However, in the context of the wood product industry within which the parent of firm E operates, the volume of remanufactured products is extremely low. Thus the research must first decide within which context to place production in order to classify a firm. In attempting to avoid such a predicament a more realistic scheme may be devised where the range of products are taken into account. In this scheme the volume of total plant production is viewed as a factor of the number of products produced. Thus, a firm may

remanufacture a high volume of lumber each year but in producing fifty different products is classified as low volume 'batch' production, whereas the production of 20 million board feet (a moderate volume of output for remanufacturers) of a single product is classified as high volume production. Using a classification which emphasizes the nature of production, rather than just the total volume, might allow more accurate predictions about the implications for labour and technology.

Is Flexible Specialization Beneficial?

To what extent the emergence of flexible specialization is wholly beneficial remains unclear. The implications of flexible technology for labour continues to be debatable, although this thesis does suggest that the nature of labour flexibility is largely a reflection of a firms position within a flexible production system.

Evidence suggests that the utilization of flexible labour and technology, combined with the external flexibility attained through contracting out, is beneficial by enabling firms to react quickly to market changes and fragmentation. However, to what extent mass consumption has become fragmented so as to necessitate such product flexibility remains an issue for debate out of the scope of this thesis.

Research in the remanufacturing sector suggests that flexibility is, to a great extent, a result of market uncertainty and fibre supply inconsistency. If this is the case, how can policy best promote industrial flexibility? The role of government, be it local, regional or national, remains uncertain in developing flexibly specialized production systems. Recent overt government intervention in France to sustain the previously viable *systemé Motte* industrial districts of has resulted in industrial failure (Ganne, 1992), whilst government intervention in the economies of North America is greeted with animosity by the business community. Under these circumstances the most successful policy must largely be derived from within the business community itself in the form of business associations, or through a public - private partnership where the role of government is tempered by business

interaction. The agency must promote trust and cooperation between producers so that firms are able to utilize the flexibility that exists within the production system as a whole to react to market dynamism and economic challenges.

Finally, regional development policy has traditionally been based upon the diversification of production around a limited number of products, diversifying into a full range of economic activities, with regions eventually becoming self-sufficient. However, if we are witnessing the re-emergence of the industrial district where firms agglomerate to produce a limited range of products (for example, forest products, films, or automobiles) what implications does this have for regional development? Are we witnessing the development of an 'industrial mosaic' where each industrial district specializes in producing only a handful of products and where trade becomes increasingly important? That is, do industrial districts represent the antithesis of traditional regional development theory? This question demands further research in an attempt to understand the future of regional development and trade. Such research needs to investigate the significance of international trade agreements such as the Canada - United States Free Trade Agreement or the implications of a North American Free Trade Agreement upon industrial districts. Several Lower Mainland forest product firms have relocated to Washington State since the implementation of the Free Trade Agreement in 1989. Does this signify a fragmentation of industrial districts? Does free trade produce a bifurcation of industrial districts across national borders in search for cheap labour? What are the implications of free trade for industrial districts manufacturing similar products either side of the boarder? Are we to witness an escalation of countervailing duties between Canada and the United States in an attempt to protect competing industrial districts? Will firms in otherwise competitive industrial districts develop a relationship founded on competitive - cooperation or will distance prevent this? The emergence of Free Trade in North America and the possibility of a single economic Europe raises many questions about industrial districts and the benefits of flexible specialization as an economic strategy.

Appendix

Interview Structure - Brainstorming sheet

Background
numbers employed - Full; Part; Temp; other (Dec. 1981, '84, '86, '91)
seasonality?
why (not) Part Time?
breakdown (1981, 86, 91/sex) - admin, clerical, trade, production, other
ownership
location
age of firm
sales and exports (9181, 86, 91) (BC, RoC, US, Japan, Europe)
product mix (1981, 86, 91)

Supplies / Markets
backward linkages-
Supplies
quantity (1991, 86, 81)
fibre type and species (%) changes over time
quality
suppliers and location, when, why, % sourced
contracts with supplier(s)
stability
changes over time (1981, 86, 91)

forward linkages-
markets
who eventually buys your product
wholesaler? where, when, why, contract?
where are customers (%)
nature / length of contract with customers
stability of market and market
market changes over time
mass vs niche market
new products?
new market areas?
new supply contracts?

sub-contracting?
subcontracted? whom? where? when? nature? contract? %?
contract out? why? why them? whom? where? when? nature? value? contract?
supply system - time, stocks, stability, dependency.

Labour (Employment)
labour costs as % costs (81, 86, 91)
wages rates Full Time per hour (+ variation job to job/time)
wage rates for part timers
non-wage benefits? (why, variation, when if applicable)
unionization? - (when), why, effect
job demarcation? - nature, why, effect
job rotation? - why, how, who (character), training, effect, attitudes
multiple skills - extent, who, why
important labour issues, (how addressed)

seniority system? how, when, attitudes
promotion? how
'other' workers - characteristics, external to firm?
layoffs? - how many, why, what jobs, layoff system? attitudes
method of employee enrollment
Is there a Local Labour Market? skills needed by workers
training? (in-house / external), from where? amount? formal/in-formal?

Investment
Major investments in last 10 years, (when, why, how, who, reason, impact)
source of machinery, custom built? why?
computers used? (where, what, when, why, use of CAD / CAM systems)
affect upon labour, attitudes
% revenue invested into production methods
nature of machinery investment (to innovate or increase productivity), why? effect?
Do R + D? Regular budget? (e.g. 1981, 86, 91)
source of innovation / ideas
affect on product mix, changes over time, why?
R + D joint venture? when, who, why, what

Inter-firm relationships
Social contacts with other businesses? who, nature, frequency, where
how are these beneficial (why bother?)
how many remanufacturing firms?
information sharing? who, why, when, e.g.?, affect
communal facility sharing? why, who, where, affect
joint venture, licensing, cross-licensing agreement?
why, who, where, when, e.g.?, nature, affect
location
Always located at this site? (no?) when moved, from where, why there
Why locate here? advantages, disadvantages
locational factors? why Lower Mainland, changed over time?
services (1991, 86, 81) (local or outside area?)
transportation?
accountancy?
computer programming / consultancy?
cleaning?
catering?
future?
products
technology
markets
location
employment

Thank-you very much !

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