RECESSION, RESTRUCTURING AND ROUTINE: THE CASE OF BC'S FOREST INDUSTRIES 1980-2008

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Klaus Edenhoffer
Master of Arts, Simon Fraser University, 2007
Diplom, University of Regensburg, 2003

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Name: **Klaus Edenhoffer**

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Examining Committee:

Chair: **Name**
[Correct title – Consult your Grad Secretary/Assistant

Dr. Roger Hayter, Senior Supervisor
Professor of Geography, Simon Fraser University

Dr. Geoff Mann, Supervisor
Associate Professor of Geography, Simon Fraser University

Dr. Martin Andresen, Supervisor
Assistant Professor of Criminology, Simon Fraser University

Dr. Sean Markey, Internal Examiner
Associate Professor of Resource and Environmental Management, Simon Fraser University

Dr. Trevor Barnes, External Examiner
Professor of Geography, University of British Columbia

Date Defended/Approved: March 30, 2012

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ABSTRACT

For several decades, BC's forest industries have been in crisis, experiencing a sequence of booms and busts. Beginning with the 1980s recession, which is widely recognized as a paradigmatic turning point, the industry has undergone extensive restructuring. Simultaneously, harvest levels started to decline, marking entry onto the so-called plateau stage of the resource cycle.

This thesis examines the industrial restructuring of BC's forest industries since 1980. Conceptually, the theoretical framework integrates the industry life-cycle model with the resource cycle thesis to create the RILCM (resource industry life-cycle model). The RILCM recognizes the distinctive trajectories of resource industries as a result of their direct exploitation of nature, vulnerability to economic and non-economic influences, and booming and busting. This thesis argues that the high volatility of BC's forest economy is not simply demand-driven but results from the combined influences of paradigmatic industrial change, declines in resource availability and increased trade, environmental and cultural conflicts that have initiated a significant re-regulation of BC's forest economy.

Empirically, this thesis applies both qualitative and quantitative research methods; those include time-series analysis, comparative static analysis based on information retrieved from industrial directories, a corporate case study of Canfor, BC's largest forest firm, and a field survey of surviving sawmills. In evolutionary perspective, BC's forest industries enjoyed stable growth from 1946 to 1970. Growth rates became more volatile during the 1970s and have levelled off or declined from 1980. In terms of industrial organization, rationalization and consolidation resulted in aggregate job loss, factory closures and the breaking up of the large previously dominant Fordist corporations. Restructuring has led to the evolution of a dual industry structure and re-defined core-periphery relations. Thus commodity production in large sawmills and pulp mills continues in the periphery, a dynamic value added segment has emerged in Metro Vancouver and other urban cores.

More generally, this thesis argues the need for understanding how regions and industries respond to prolonged periods of crisis and volatility. Evolutionary approaches to economic geography need to incorporate resource peripheries and crisis and acknowledge the role of non-economic factors in shaping regional transformation.

Keywords: resource industry life cycle; resource peripheries; economic crisis; evolutionary economic geography.

For Dingding

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GLOSSARY

AAC	Annual allowable cut
ABCFP	Association of BC Forest Professionals
BC	British Columbia
BCFP	British Columbian Forest Products
BCMoF	British Columbian Ministry of Forestry[1]
BCTS	BC Timber Sales
BF	Board feet
CANSIM	Canadian Socio-Economic Information Management System
CEO	Chief execute officer
CFCI	Coast Forest Conservation Initiative
CFCLI	Coalition for Fair Canadian Lumber Imports
COFI	Council of Forest Industries
CORE	Commission on Resources and Environment Act
EBIT	Earnings before interest and taxes
EEG	Evolutionary Economic Geography
ENGO	Environmental non-governmental organization
ICT	Information and Communication Technology
ILC	Industry life cycle

[1] In November 2010, the British Columbia Ministry of Forest and Range was renamed Ministry of Forests, Mines and Lands. In this thesis, the ministry is referred to as BCMoF/British Columbian Ministry of Forests regardless of this and earlier name changes.

M&A	Mergers and acquisitions
MAUP	Modifiable areal unit problem
MB	MacMillan Bloedel
MMBF	Millions of board feet
MMSQF	Millions of square feet
MPB	Mountain pine beetle
NEG	New Economic Geography
OSB	Oriented strand board
R&D	Research and development
RBC	Real Business Cycles
ROCE	Return on capital employed
SLA	Softwood Lumber Agreement
SME	Small and medium enterprises
SPF	Spruce, pine and fir
SY	Sustained Yield
SYP	Southern yellow pine
TEP	Techno-economic paradigm
TFL	Tree farm license
USW	United Steelworkers

1: INTRODUCTION

British Columbia's forest economy is in crisis. While the recent recession, which started in 2007, seems to have bottomed out and the forest industry is slowly recovering, that crisis is only the most recent one in a series of booms and busts that have become routine for the industry. That volatile period has lasted for four decades, if the 1973 oil crisis is used as starting point, and for at least three decades since the severe 'turning point' recession of the early 1980s. Indeed, this period of booms and busts, whether or not the crises are connected, has been longer than the preceding long Fordist boom that occurred from the late 1940s to the early 1970s. In association with this economic volatility, the BC forest industry has experienced considerable technological changes and a barrage of policy initiatives that have fundamentally changed the underlying timber supply and product demand conditions in which it operates. As part of these changes, industry's hitherto privileged access to BC's forests, traditionally perceived solely for their industrial values, has been modified. In this regard, the early 1980s recession can be considered as a turning point, not only because of its unusual severity, but because it strongly signalled the need for industrial restructuring. This thesis addresses the geographical implications of this restructuring principally from 1980 to 2010.

For BC's forest industry, restructuring during this turbulent period has been characterized by rationalization, consolidation, and disintegration among the mainstream commodity industries, dominated by large firms, some growth of value added activities organized by small firms, and by a transformation in geographic patterns with respect to the balance between the Coastal and Interior forest industries and their core-periphery structure. This thesis analyses the restructuring of BC's forest industry from aggregate, corporate, and factory level perspectives with a geographic focus on the province as a whole. Broadly speaking, restructuring is understood to imply profound changes in the competitive, organizational, technological, and geographic conditions underlying the industry. The focus of this research is on the 'how' and 'why' of restructuring over a long period of time characterized by high levels of volatility, and its implications for spatial patterns and structures. An underlying theme is the resilience of the BC forest industry and whether or not it can be characterized as a 'sunset industry'.

This study seeks to integrate two sets of literatures, respectively on resource peripheries and evolutionary economic geography. In recent years considerable emphasis has been placed on the need for evolutionary explanations in economic geography, even raising the possibility for a new approach or 'turn' for the sub-discipline. The industry life cycle model (ILCM), path dependency, lock-ins, cumulative causation, selection, adaptation, and variation are the key concepts that have been employed to explain location dynamics over long periods of time, especially with respect to cluster or agglomeration dynamics (Li and Bathelt 2011; Martin and Sunley 2011; Potter and Watts 2010; Ter Wal and Boschma 2011). So far, however, resource peripheries have been largely neglected. Yet as a general category, distinct from core regions, resource peripheries are subject to different interplays of global-local dynamics. In this regard, booming and busting, or simply volatility, is often seen as an important characteristic of resource peripheries. However, volatility is a surprisingly neglected theme in the recent surge of interest in evolutionary economic geography. By focusing on the geographical implications of volatility in BC's forest industries over a long period of time, this study seeks to contribute to responding to these two significant lacunas in evolutionary economic geography.

The overall objective of this chapter is to introduce the research methodology with respect to broad theoretical and literature, goals, methods of analysis and sources of information, and the structure of this thesis. Section 1.1 discusses the role of resource economies and peripheries as particular regions. Section 1.2 provides an overview over evolutionary approaches in economic geography. Section 1.3 presents the research questions. Section 1.4 concludes with an outline of the thesis.

1.1 Resource Economies and Peripheries

Resource peripheries (Hayter et al. 2003; Reed 1993; 1995) are subject to their own evolutionary dynamics, which is fundamentally different from the core. Resource peripheries are subject to place-specific constellations of strong institutional forces, based both within and outside the region (Barnes and Hayter 2005). Furthermore, those powerful non-market forces distort the ways in which economic 'laws' function; *"[r]esource peripheries are sites of complex, often conflict-ridden institutional relations that connect industry, politics [...] culture, and the environment, and they are typically not found in core economies or their representations*" (ibid. 458). Therefore, resource economies are subject to a number of distinct features. For instance, they are price takers and not setters (Markey et al. 2000, 429). Commodity prices for most raw materials are volatile and alternating periods of boom and bust are a common experience for most resource industries. Harold Innis used the metaphor of the cyclone (Barnes et al. 2001) to describe the extreme dynamics at work in resource regions, leading to the rapid growth and decline of resource communities. "*Blowing across the economic landscape, global-cyclonic winds touch down at a few sites – single-industry towns – to create in a burst of frenetic energy the infrastructure and wherewithal of resource production*" (ibid. 213). The forces unleashed by such a cyclone are both creative and destructive. *"[M]ills and mines are shut down, workers are laid off, businesses go belly up, home mortgages are foreclosed, families break up, and local governance is turned upside down. In this case, the institutional glue holding staples together loses its power of adhesion, resulting in dissolution, fragmentation, and chaos"* (ibid. 213).

Limited linkages to other sectors of the national economy often causes the resource sector to turn into an economic enclave, which might lead to imbalances and problems such as the Dutch Disease or the Resource Curse (Auty 1993; 1995), including high inflation, appreciation of the currency and other issues for economic development. In such ways, heavy dependence on natural resources can cause "*economic addiction*" (Freudenburg 1992, 306). High wages in resource industries can create the "*intrusive rentier syndrome*" (Polese and Shearmur 2006, 39), a localized version of the Dutch disease, as large, capital-intensive industries such as mines, sawmills, or pulp mills located in small communities drive up wage expectations and constrain economic diversification.

Resource extraction at individual sites as well as in the region as a whole is subject to the resource cycle (Clapp 1998). The trajectory of peripheral resource communities and regions is characterized by rapid growth, a plateau phase, and eventual decline and/or transition (see also Barnes and Hayter 1994; Bradbury and St-Martin 1983; Halseth 1999a and b; Lucas 1971; Markey et al. 2008; 2009). Over time, resource industries face a cost-price squeeze (Freudenburg 1992). Exploitation costs are rising as the most plentiful, most easily accessible resource sites are exploited first. Gradually the access to new sites, for example through forest roads, becomes more difficult and expensive. In addition, resource industries face increasing competition.

Technological progress, such as improvements in exploration, transportation, or mining technology, makes it economically viable to exploit even sites that are remote and/or difficult to access. Therefore, world supply of a given resource is increasing over time, which results in falling prices and profit margins. In the case of timber this is aggravated by the falldown effect; timber harvest typically declines over time, as logging is shifting from old growth forests to second growth stands in which large trees have been replaced by younger trees with smaller volumes of wood (Dunster and Dunster 1996).

Despite those common features and characteristics, resource peripheries are highly variegated. They vary with the nature of the particular resource, such as oil, minerals, forests, or fisheries. There are rich and poor resource peripheries, they are located in industrialized or developing countries, their geographic situations within particular countries and market accessibility differs considerably, as do their histories, culture, and population. In such ways, each resource periphery is a 'special case' or unique in the sense of being shaped by distinct forms of local-global dynamics. Furthermore, natural resources possess both industrial and non-industrial values; that leads frequently to conflicts between different groups in society with contradicting beliefs and concepts about their use. Those conflicts are not just 'economic' but often engage non-economic interests and values, such as environmental protection, 'natural beauty' and spiritual values. These non-economic factors cannot be ignored in economic-geographic analyses.

British Columbia's is located on the periphery in a dual sense, in relation to both the Canadian and global economic cores. This has influenced economic development from the beginning. Natural resources have always played a crucial role for BC and the industrialization of the province – as for Canada as a whole – was based on staple extraction and the eventual creation of linkages and multipliers (Hayter and Barnes 1990; Howlett and Brownsey 2008; Innis 1956; 1977; Innis et al. 1930; Mackintosh 1953; Watkins 1963, Wellstead 2007). Since the late 1970s, the spaces of British Columbia have been contested by environmentalism, Aboriginalism, and geopolitical forces (Hayter 2003). Power relations changed and a new set of actors emerged, each of them with a different concept of how to utilize the province's resources, about their monetary, ideological, or spiritual values.

The consequent "*remapping*" of BC's resources from industrial uses to other purposes (Clapp 2004; Hayter 2004b) has resulted in major planning uncertainty for the forest industry. The strong role of institutions in BC's forest economy has shaped the development path of actors and strongly influenced the economic development and evolution of the province.

1.2 Evolutionary Approaches in Economic Geography

In recent years, economic geography has paid increasing attention to evolutionary concepts such as embeddedness, industry life cycle models, lock-in, and path-dependence (Granovetter 1973; Schamp 2000). Recently this trend has led to the emerging research field of evolutionary economic geography (EEG) or at least to an emphasis on evolutionary approaches within economic geography (Boschma 2004; Boschma and Frenken 2006; Boschma and Lambooy 1999; Boschma and Martin 2007; 2010; Essletzbichler 2007; 2009; Essletzbichler and Rigby 2005; Essletzbichler and Winther 1999; Frenken 2007; Grabher 2009; Hodgson 2001; 2009; MacKinnon 2008; Rafiqui 2009; Rigby and Essletzbichler 1997). These developments have drawn considerably from related literatures in business and economics (Chandler et al. 1998; Nelson 1995; Nelson and Winter 1982; 2002). EEG is still a work in progress, lacking a universal framework and combining a plethora of research methods. According to Hodgson, the most general challenge facing evolutionary approaches across the social and natural sciences is to develop Generalized Darwinism with its principals of variation, selection, and heredity as a "*metatheoretical framework*" (Hodgson 2009, 170). Whether or not such a metatheoretical framework is possible, EEG is closely linked with long established traditions in institutional thinking, particularly associated with institutional, radical, dissenting or evolutionary economics. The concepts associated with this thinking are central to EEG. In many ways, EEG is a response to the "*New Economic Geography*" (NEG) propagated by Fujita (1988), Krugman (1991a and b) and Venables (1996). NEG draws upon neoclassical assumptions, methods, and models. The main differences between neoclassical and evolutionary approach are well known and may be briefly summarized (table 1.1). While neoclassical theory is concerned with quantitative factors and generalized "laws" and regularities, evolutionary approaches emphasize qualitative factors, history, and path dependence.

Table 1.1 Comparison of neoclassical and evolutionary approach

Neoclassical Theory	Evolutionary Theory
Use of physical metaphors	Use of biological metaphors
Equilibrium as central concept	Emphasis on factors causing disequilibrium
Static/comparative statics	Dynamic
High degree of precision	Less precise, open to non-quantifiable factors
Assumes perfect information	Operates under uncertainty
Time is not an issue	"History matters"
Entrepreneurship is unimportant	Entrepreneurship is a central factor
"All economic activities are equal" (potato chips, wood chips, computer chips)	Economic activities are different because there are innovation "focuses" at any point of time
The "representative firm"	Heterogeneous firms; the "representative firm" does not exist
The market as price setter	The market also as selection mechanism among firms
Technology as a free good	Technology as an important factor in wealth creation and distribution

Source: based on Drechsler et al. (2009, 12) and Reinert and Riiser (1994)

Surprisingly, crises and recessions and the part they play in economic evolution are downplayed not only in equilibrium-focused NEG but also in EEG. Recessions and crises are of course a well-known feature of economic evolution but may not be believed to have a lasting impact. If so, such an assumption is surprising, as the pioneers of evolutionary economic approaches, such as Schumpeter and Kondratieff, recognized the crucial role of crises and recessions and stressed their importance for industrial development. Indeed as Grabher (1993, 266) points out, dramatic crises can break lock-ins and reshape evolutionary development.

EEG is not a-priori confined to a specific geographic scale and evolutionary approaches have been applied to the analysis of nations, regions, and cities as well as to sectors and firms. Nevertheless, most of the work in EEG is biased towards agglomerations of secondary manufacturing firms in economic cores. Furthermore, it is focused on small firms in early stages of the life cycle and in high tech sectors. Those firms and plants are by nature subject to rapid growth and expansion of output and employment. In recent literature, however, the dynamics of mature industries, including job loss, plant closures, contractions, and decline, are neglected if not ignored research topics (see, for example, Schamp 2000). Whereas much of the literature focuses on secondary manufacturing industries located in the core, this work takes place in a resource periphery context. Resource peripheries are distinctive, vital to the global economy and connected to cores.

1.3 Research Questions

This thesis seeks to contribute to EEG by focusing on the evolutionary dynamics of a mature resource economy, namely the restructuring of BC's forest industry. Overall, this work intends to broaden the mandate of EEG by emphasizing the distinctive nature of resource industry restructuring, particularly with respect to the implications of volatility during the mature and plateau stage of the resource cycle. These contributions are demonstrated with a detailed analysis of the evolution of BC's forest industries especially between 1980 and 2010. The broadly stated central research question is:

What are the main contours of the restructuring of BC's forest industries between 1980 and 2010 during a period of ongoing booming and busting, or volatility? This question can be further disaggregated: What are the distinctive evolutionary paths of the main forest industries? How has the relationship between plateaus, paradigm change and crisis influenced their restructuring? How have firms and factories responded to volatility and economic crisis? Has volatility affected forest policy? What are the implications for the core-periphery structure of BC's forest industry?

The conceptual point of departure for this analysis is provided by two strands of literature in evolutionary economics namely the industry life cycle model (ILCM) initially proposed by Abernathy and Utterback (1975) and further developed by Klepper (1996) and Freeman's and Perez's theory of economic evolution known as the techno-economic paradigm (TEP) model. The latter complements the ILCM with respect to the importance of 'turning points' or 'structural crises of adjustment'. The ILCM is further elaborated according to Clapp's (1998) resource cycle model to create the resource industry life cycle model (RILCM). The RILCM provides the context for analyzing BC's forest industries.

Empirically, the analysis focuses on the evolutionary geography of BC's forest industry, mainly between 1980 and 2010, although reference to prior periods is essential for a proper understanding of changes in recent decades. The study seeks to identify the broad contours of restructuring in BC to provide insights into overall directions of industrial and geographic change, and to encompass the implications of volatility as much as possible. The development of BC's forest economy has been closely connected with the evolution of particular institutions operating at the provincial scale. Thus, in order to understand the broad patterns of restructuring and the underlying institutions and policies, it is important to take an aggregate perspective on the BC forest industries as a whole. This aggregate or industry perspective is complemented by investigations at the sub-industrial, corporate and factory level. The project draws upon and complements a rich inter-disciplinary institutional or political economy literature on BC's forest economy, particularly complementing earlier studies of industrial restructuring in the 1980s (for example Barnes and Hayter 1997; Grass and Hayter 1986; Hayter 2000; Marchak 1983).

The framework of this research is tailored for the particular case of BC. Caution needs to be exercised when transferring the results and findings to other places. Although this thesis provides some broad insights into the interrelations of recession, restructuring and institutional change, the local context matters and has taken into account when generalizing the results.

1.4 Methodology

Forestry and logging include all primary activities associated with timber growing, harvest and reforestation on a long production cycle (10 years or more). The wood product manufacturing industry processes wood by sawing, planing, shaping, laminating, and the assembling of wood products. The three sub-categories are sawmills and shingle mills, veneer and plywood mills, and "other" (value added) wood industries. The latter include millwork and the manufacturing of wood containers, pallets, and other products, such as prefabricated buildings and log homes. Paper and allied industries produce pulp, paper, and converted paper products: pulp manufacturing involves separating the cellulose fibres from other impurities in wood or used paper; paper manufacturing involves matting these fibres into a sheet; value added paper industries (converted paper manufacturing) include the production of paperboard containers, paper bags, stationary products, sanitary paper, etc; and converted paper products are made from paper and other materials by various cutting and shaping techniques, coating, and laminating activities.

Table 1.2 BC forest industries, industrial classification

Terminology used	SIC (Standard Industrial Classification, 1948-1997)	NAICS (North American Industrial Classification System, since 1997)
Forestry and logging	C Logging and forestry	113 Forestry and logging
Wood product manufacturing	25 Wood industries	321 Wood product manufacturing
Paper and allied industries	27 Paper and allied industries	322 Paper manufacturing

Source: Statistics Canada

This thesis draws upon various information sources for the empirical analysis. These sources include secondary data published by government agencies, such as the CANSIM database by Statistics Canada, the BC Economic and Statistical Review and the BC Financial and Economic Review by the BC Government, the annual reports and various papers and bulletins by the BC Ministry of Forests, and the Strategis database by Industry Canada. Data was also obtained from corporate annual reports, most notably of Canfor, and from industrial directories, such as Scott's Directories of Western Manufacturers, BC Manufacturers Directory, and Madison's Directory. Fieldwork provided additional information for this thesis. Structured interviews were conducted in summer 2009 with owners or managers of 22 sawmills across the province. In addition, three industry associations, a lumber trade company, and a labour union were interviewed.

A set of complementary research methods is applied to evaluate this information. Longitudinal profiles of various variables at an aggregate industry level are the basis for time series analyses. Based on aggregate industrial information, such as employment, output, exports, and investment, province-wide industrial trends are identified. In addition, crucial changes in the institutional environment of BC's forest industries are sketched. The essential period for this analysis is 1980 to 2008, which covers the development since the 1980s recession. Some of the time series, however, reach back until 1946 and recent years (2009 and 2010) were included if data was available. The use of quantitative methods, such as time series regression, is limited by the assumptions about this research, which emphasize the importance of institutional factors, some of which are difficult to quantify. Furthermore, due to the multiple interdependencies of variables, such an analysis would have to cope with issues of multicollinearity. Therefore, the analysis has to rely on descriptive statistics and visual analysis of the time series graphs.

A comparative static analysis investigates shifts in the population of forest product factories between two periods of time. For that purpose, a sample of forest industry production sites was collected from industrial directories for the years 1980 and 2008. This method makes it possible to identify the location of forest industry plants and classify them according to size and industrial focus; trends can be compared between small and large factories and between the different sub-industries.

Based on the BC-based forest product company Canfor a corporate case study is conducted. Canfor has a long history in BC, was one of the top five largest corporations during the boom years of the 1950s and 1960s; since the 1980s the company has emerged as the biggest lumber producer in the province. Most information is obtained from Canfor's annual reports, which are available since 1983 and contain data from 1979 on. These reports provide qualitative data on industrial key variables, such as sales, earnings, and investment along with plentiful qualitative information, such as the most important forces behind restructuring from a corporate perspective

The analysis of data obtained from the fieldwork provides insight into plant level restructuring, both of a qualitative and quantitative nature. This includes levels of production, productivity, employment, and wages as well as shifts in the fibre supply and with respect to markets. In addition, this method reveals the perception of economic crisis and institutional change by sawmill owners and managers.

The format of the thesis is as follows: In chapter 2, the relevant literature about recession and restructuring is reviewed, both from a conventional/ neoclassical and from an evolutionary/institutional perspective. Based on this review the theoretical framework is developed: a local model of BCs resource economy, which includes a role for both economic and non-economic factors.

The empirical analysis is revealed in four chapters. Chapter 3 sketches the long-run aggregate evolution of BC's forest industries. The analysis relies on time-series data of industry key figures such as employment, output, exports and investment, most of which were obtained from Statistics Canada, especially the CANSIM database. Those time series are related to important institutional changes that occurred since the 1970s

Chapter 4 focuses on changes in the population of forest product factories, with two major goals. First, the comparative statics of plant closures, plant openings, and in-situ restructuring between 1980 and 2008 gives insight into the population dynamics of factories, such as changes in plant numbers, employment and capacity. Second, the spatial pattern of restructuring is analyzed at the geographical scales of Forest Regions, Forest Districts, and Regional Districts. Spatial analysis methods such as regional entropy and the Andresen (2009) test address questions of spatial concentration change and possible hot spots of the different forest sub-industries.

Chapter 5 examines corporate restructuring. The first part of the chapter is based on information from the BC Ministry of Forests and other publicly available sources to analyze changes in corporate structure and concentration; it sketches the turnover of major forest companies from 1975-2010. In the second part, the example of Canfor, today BC's largest forest firm, provides insight into corporate restructuring strategies, such as changes of product line, technology, employment, and industrial organization.

Chapter 6 examines the strategy of individual sawmills, focussing on the particularly volatile period from 2000 on. The chapter analyses plant level restructuring, such as employment and technology change, the introduction of new products, and the shift to different export markets. Furthermore, the judgments of mill owners and managers are valuable sources for the assessment of the crucial reasons underlying restructuring, such as shifts in markets, fibre supply, or export regulations.

The results of the work are summarized in chapter 7, which also provides directions for further research.

2: CRISES, RECESSIONS AND RESTRUCTURING

2.1 Introduction

Capitalist economies are prone to crises and recessions that vary with respect to duration, intensity, and spatial pattern. While some recessions are mere fluctuations with few lasting impacts, others are turning points that have deep implications for long-run economic development. Such turning points involve innovation, new technologies, and significant changes in industrial organization and modes of regulation along with the creative destruction of jobs, firms, and industries.

In contemporary times, there is widespread recognition that profound changes in the structure and organization of the world economy as well as the global division of labour began to occur during the 1970s and early 1980s. Concepts such as the post-industrial society (Bell 1973) flexible specialization (Piore and Sabel 1984), flexible accumulation (Harvey 1982, 1989), globalization (Castells 1996), post-Fordism (Boyer 1988) and the information and communication technology (ICT) paradigm (Freeman and Perez 1988) were introduced and developed to herald and document these changes. In order to develop the theoretical framework, this thesis draws mostly upon Freeman and Perez, but the economic turbulence and transformations that have occurred from the 1970s across the global economy are widely recognized in the evolutionary literature. In broad terms, these developments have led to increased flexibility of the organization of production and employment, more polarization, variety, and volatility and thus to a more uneven economic landscape with new cores and peripheries.

The literature on economic evolution and explanations of crises is rich and highly varied and this chapter draws in particular from recent evolutionary approaches to economic development, industrial change, and firm behaviour that are rooted in the Schumpeterian tradition. In particular, this chapter privileges Freeman and Perez's (1988) theory of economic development and Abernathy and Utterback's (1975) industry life cycle model, both of which have been extensively developed in recent years (see Klepper 2002; 2010; Perez 2004; 2009; 2010). According to Freeman and Perez, economic development occurs in long waves (Kondratieff cycles) or TEPs that comprise distinctive mixes of technological, economic, and institutional characteristics. In Freeman's and Perez' thinking, the shift from one TEP to another involves a 'structural crisis of adjustment' that can last several decades as governments, industries, and communities try to come to grips with changing their economies from old to new ways ('restructuring'). The concept of structural crisis of adjustment recognizes so-called 'turning point recessions' and provides a heuristic basis for understanding volatility over long periods of time. The TEP model is also recognized in economic geography, as it encourages broadly based (economic and non-economic) explanations of evolution. Freeman and Perez have also recognized that their TEP model overlaps with regulation theory that has received much attention in geography. Moreover, the TEP model is readily complemented by other evolutionary concepts including the industry life cycle model (ILCM). In this chapter, this model is elaborated with respect to Clapp's (1998) resource life cycle thesis and with respect to volatility to provide a framework for understanding the evolution of resource industries.

To place this discussion in a broader literature context this chapter first reviews selected key studies about crises, recessions, and restructuring, especially distinguishing between neoclassical and institutional perspectives. The final section discusses regional implications of recessions and restructuring with a focus on resource peripheries and develops a local model to summarize the key characteristics of the restructuring of resource industries.

2.2 Business Cycle Approaches

There are a wide range of explanations of business cycles that seek to explain why economies drop into recession or bust, and why they over-inflate and boom. There are also explanations of specific crises, of which the Great Depression of the 1930s has probably received the most attention. Recessionary and inflationary periods, busts and booms, are also referred to as economic crises and as periods of volatility when linked together. Two broad categories of business cycle explanations can be recognized: neoclassical and institutional, where the latter includes Marxist interpretations of crisis. These two approaches are summarized as prelude to a fuller discussion of the TEP model and the crisis of structural adjustment.

2.2.1 Neoclassical Approaches to Business Cycles

Neoclassical business cycle theories, even as they vary substantially, define "conventional" approaches for the analysis of economic fluctuations. Typically, these approaches are economistic in nature, adopt abstract deductive thinking, assume the power of equilibrium forces, and are not especially interested in spatial variations (although a regional perspective can be accommodated). Yet these theories provide important insight into understanding business cycles, especially from a short-term perspective.

From neoclassical perspectives, a recession is a quantitative change of the relevant economic variables, such as a decrease in output, employment, or prices. In such ways, recessions are associated with more or less regular, short-run economic fluctuations. A common definition for a recession is two or more consecutive quarters of decline in real GDP. However, measures that are more flexible are sometimes applied. For example, the NBER's Business Cycle Dating Committee defines a recession as "*a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in production, employment, real income, and other indicators. A recession begins when the economy reaches a peak of activity and ends when the economy reaches its trough. Between trough and peak, the economy is in an expansion*"[2].

Short and medium run economic fluctuations are known as "*business cycles*" (Burns and Mitchell 1946; Kydland and Prescott 1982). In neoclassical economics, there exist different macroeconomic schools of thought (Phelps 1990). To summarize this literature, following Arnold (2002) and Knoop (2004), five major business cycle theories can be distinguished (Table 2.1). Their common denominator is the general belief in a state of equilibrium that occurs when supply equals demand in all markets (for goods, money, labour, and exports), and there is no incentive for individual producers and consumers to change their behaviour. In equilibrium, also called "steady state", economic variables grow at a regular rate. Neoclassical economics considers growth and fluctuations to happen independently; therefore economic development is decomposed into a cyclical component and a growth component[3].

Business cycles or fluctuations are the result of unexpected temporary forces or "shocks" that shift the economy out of equilibrium. In such ways, business cycles are short run deviations from equilibrium. From this perspective, a crisis is solved by creating

[2] Announcement from the NBER's Business Cycle Dating Committee from 12/01/08; http://www.nber.org/cycles/recessions.html (retrieved March 21, 2011).

[3] Economic growth models constitute a different class of neoclassical models. They are not considered in this thesis.

the conditions that allow the economy to move back to equilibrium. In neoclassical view, a crisis is a merely quantitative phenomenon; variables (such as GDP, investment, or unemployment) are subject to – sometimes radical – dimensional change, but the intricate relationships between the variables are assumed to remain constant.

The five macroeconomic schools have different opinions about where these shocks originate and whether they affect the supply or demand side. It is also argued about how much damage or efficiency-loss a recession causes in the economy. There is further disagreement about whether there exist forces inherent to the economy that will ultimately cause the economy to return to equilibrium (the “invisible hand of the market”) or whether this requires government intervention on either the supply or the demand side, using either fiscal or monetary policy. The fundamental belief, however, that all schools share, is that under certain circumstances the economy will (or at least can) move back into (dynamic) equilibrium in the sense that the forces of demand and supply are balanced. In such ways, these business cycle theories are void of any qualitative changes occurring in the economy. Indeed, the neoclassical business cycle literature involves strong assumptions that limit its insights. First, business cycles are macroeconomic theories, designed for aggregate national economies; their findings cannot be transferred directly to other geographical scales, such as regions or communities. Second, the neoclassical role of the firm is abstractly conceptualized. Firms are assumed homogenous and driven by economic self-interest; they merely consist of a production function that converts inputs (labour, capital) into output in a profit-maximizing way. Third, qualitative changes in economic systems are left out. Neoclassical business cycle theory has no place for the restructuring of economies, firms and industries that implies the importance of evolutionary processes. Likewise, models of business cycles include only a limited role for institutions; all economic dynamics are derived from the maximizing behaviour of rational agents. In general, although neoclassical economics acknowledges that crises and recessions happen frequently and are an inevitable part of a capitalist economy, they are treated as a deviation from equilibrium and therefore as anomalies. The evolutionary perspectives provide alternative ways of thinking.

Table 2.1 Overview of neoclassical business cycle theories

	Keynesian Economics	**Monetarism**	**New Classical Economics**	**Real Business Cycles (RBC)**	**New Keynesian Economics**
Leading theorists	John M. Keynes	Milton Friedman	Robert Lucas	Finn E. Kydland, Edward C. Prescott	Ben Bernanke, Olivier Blanchard, N. Gregory Mankiw, Joseph Stiglitz
Key as-sumptions	Inflexible wages, imperfect labour markets	Perfect competition, flexible prices and wages	Rational expectations, flexible prices and wages	Rational expectations, maximizing behaviour, perfect competition	Rational expectations, maximizing behaviour, inflexible prices and wages
Focus	Demand side	Supply side	Supply side	Supply side	Demand side
Origin of business cycles	Fluctuations in investment and consumption demand	Fluctuations in aggregate demand due to changes in money supply	Output fluctuations happen only when unpredicted changes in money supply occur.	Fluctuations arise from maximizing behaviour.	Fluctuations in investment and consumption demand
Role of govern-ment	Government can stabilize fluctuations by increasing aggregate demand. Government spending should be anti-cyclical.	No need for government intervention because market forces will move the economy back into equilibrium. Government should keep the money supply stable and predictable.	Stabilization policy can only be effective if not anticipated. Government should keep the money supply stable and predictable.	No efficiency is lost through business cycles. Government intervention is not necessary.	Government can stabilize fluctuations by both fiscal and monetary policy
Fiscal policy	Effective	Ineffective	Ineffective	Ineffective	Effective
Monetary policy	Effective	Only temporarily effective	Ineffective	Ineffective	Effective

Source: Based on Knoop (2004) and Arnold (2002)

2.2.2 Institutional Approaches to Business Cycles

Evolutionary theories of crisis emerged as an alternative to neoclassical orthodoxy and reach back to Marx, Kondratieff and Stolper (1935), Schumpeter (1939 [1964]; 1942 [1950]), Schumpeter and Opie (1911 [1961]), and Veblen (1898). Since the 1970s, they have received increased attention. Unlike neoclassical business cycle themes, evolutionary approaches lack a shared underlying methodology for understanding recessions and crises. Instead, they are based on different theoretical foundations. Those include evolutionary institutionalism (see Atkinson 2004; Dosi 1988; Dosi et al. 2008; Freeman and Perez 1988; Hodgson 2001; Nelson and Winter 1982; Streeck and Thelen 2005) as well as concepts rooted in Marxist views, such as regulation theory (Aglietta 1976 [1979 in English]; Bathelt 1994; Boyer and Saillard 2002; Hirsch 1990; Jessop 1990; 2002; Jessop and Sum 2006). Marx himself was one of the first economists to acknowledge the existence of business cycles (see Mandel 1971, 67-78) and to recognize crises as inherent features of capitalist economies.

Evolutionary approaches tend to take a long-run view on economic development. Although there exist institutional theories that have emphasized shorter periods such as Kitchin (3-4 years), Juglar (7-11 years), or Kuznetzk cycles (15-25 years), perhaps the most influential approaches suggest movements of the world economy that take the form of periods, cycles, or waves of 30-50 years of duration. The extensive literature on long waves is reviewed by Freeman (1996), Goldstein (1988), and Louçã and Reijnders (1999) and the main characteristics need only be summarized here (see Freeman and Louçã 2001, 147f; Perez 1983; Reati and Toporowski 2009, 155f).

Economic evolution in most long wave models is driven by the duality between two spheres. The “regime of accumulation” or “techno-economic sphere” (Freeman and Perez 1988) regulates the technological and organizational system of production. The “mode of regulation”, “social structures of accumulation” (Gordon 1980), or “socio-institutional sphere” (Freeman and Perez 1988) includes social and political institutions that enhance the balance of power between workers and capital, issues of consumption, and the correspondence between the technological potential and the realization of that potential (Tylecote 1992, 239). Interdependencies between the two spheres result in a Myrdalian system of circular and cumulative causation which leads to self-enhancing process of economic growth. Eventually that system breaks down, resulting in recession and crisis.

Key aspects of long wave theory in selected schools of thinking are displayed in table 2.2. The different schools of long waves disagree about what causes long waves to emerge, they remain unspecific about what processes lead to cause a crisis, how that crisis happens, and in some cases about the role of innovations and technology. Over time, however, "*differences between schools of thought became smaller and more hybrid theories integrating principles from all schools arose*" (De Groot and Franses 2012, 60).

This thesis privileges Freedman’s and Perez’ TEP model as an explanation of long run economic development, for several reasons. Thus, their framework emphasizes the interactions of institutions and technology and between social and economic processes as a way of thinking about long run economic development without being deterministic and that recognizes the role of geographic differentiation. The role of resource peripheries can be readily incorporated within this framework. Moreover, the TEP model explicitly recognizes the importance of structural crises as turning points and the challenge of developing new policies and structures for new paradigms. In the following, the TEP is examined more thoroughly.

Table 2.2 Overview over selected long wave theories

	Marxist capitalist crisis school	**Investment school**	**Innovation school**	**Institutionalist school**
Main representatives	Ernest Mandel, David Gordon David Harvey	Nikolai Kondratieff, Jay Forrester	Joseph Schumpeter, Gerhard Mensch	Christopher Freeman, Carlota Perez
Main driving force behind long waves	Falling profit rate	Investment	Innovations	Interaction between techno-economic and socio-institutional sphere
Explanation of upswing	Forces that work against the falling profit rate	Capital over-expansion; "self ordering" of capital	Emergence of new innovations	Propagation of a technological revolution across economy and society
Explanation of down-swing	Falling profit rate slows down economy, leading to overcapacities and class struggle	Investment decline	"Stalemate in technology"; failure to introduce new innovations	Exhaustion of techno-economic paradigm; declining profit rates
Reasons for crisis	Stagnating economy; contradictions within the social structure of accumulation	Excess capital is physically worn out and depreciated	Product life cycle; saturated markets	Institutional inertia; mismatch between techno-economic and socio-institutional sphere
How is the crisis resolved?	"Destructive adaption" of capital; class revolution, establishment of socialist society	Improvement of corporate and social management	Clusters of innovation emerge; new growth in new economic sectors	New TEP emerges
Role of innovations; cause or effect of LW?	Effect; investment in new technologies takes place during expansion	Effect; investment in new technologies takes place during expansion	Effect; investment in new technologies takes place during expansion	Cause; investment in new technologies takes place during downswing

Source: based on De Groot and Franses (2009; 2012); Goldstein (1988, 41).

2.3 The TEP Model – Crises as Mismatches

Freeman and Perez (1988) developed a widely known 'institutionalist' conceptualization of long-wave theory that draws upon Schumpeterian traditions and relates long waves to 50 year Kondratieff cycles (see also Perez 2002; 2004; 2009; 2010). In their approach, economic development is organized around TEPs that are driven by technology (innovations), capital, and institutional evolution (including organization, habits of thought, regulatory framework, values, and beliefs). TEPs feature the co-evolution and complimentary matching of techno-economic and socio-institutional spheres. Tensions, conflicts, and recessions are explained by mismatches in these spheres or dysfunctionality in their co-evolution.

Although not mentioned in table 2.2, the TEP model widely overlaps with regulation theory (Boyer and Saillard 2002), especially in relation to the interpretation of Fordism and the restructuring of Fordism in recent decades towards the information and communication TEP (ICT) in the case of the former approach. "*There is broad agreement [...] over: the systemic and cyclical nature of capitalist development; the periodization and general dynamic of Fordism; the significance of the degree of match between, in neo-Schumpeterian language, the 'techno-economic paradigm' (regime of accumulation) and the 'socio-institutional framework' (mode of regulation); and the stability of a 'long wave' or 'long cycle' in economic development*" (Amin 1994, 11).

As a crucial distinction, however, the TEP model privileges the role of innovation in economic evolution whereas technical change is largely ignored in regulation theory (Amin 1994, 11; Hayter 2008a, 837).

A TEP is "*the set of the most successful and profitable practices in terms of choice of inputs, methods and technologies, and in terms of organizational structures, business models and strategies*" (Perez 2009, 10). The TEP relies on one or more "core inputs" or key factors such as iron, coal, steel, oil or microchips. Those core inputs are supplied at low and decreasing relative costs and can be used in many products and processes throughout the economic system. The sectors producing these core inputs (the "motive branches") are major industries in each long wave. The new products, which are based on those core inputs, stimulate the rise of other new industries ("carrier branches"). Their rapid growth and great market potential encourages further growth in the entire economy. A process of cumulative growth can start, reinforced by the other branches that follow the leading sectors (the "induced growth branches"). In each long wave, new infrastructures have to be built up to serve the requirements of new industries

Thus, the TEP model emphasizes a best practice in which a set of technological systems matches a set of organizational practices via a lock-in, matching or "*coupling*" process (Perez 2004, 1) which involves several interconnected processes of adaption and change (ibid. 7). In such ways, each long wave is closely associated with a particular TEP. In this model, TEPs eventually run out of steam, productivity gains decline or become negative and economic crises more prolonged as established routines are undermined, and there is a need to establish a new TEP with new matching technological and institutional characteristics. The combination of the demises of the old TEP and the search for a new one creates a structural crisis of adjustment.

The restructuring that arises from the installation of the new paradigm calls for institutional innovations needed to design, produce, use, and distribute the new products. Gradually a new "common sense" for managing and organizing the new paradigm emerges through trial and error and spreads from new industries into the old ones. Eventually a new lock-in, or match, will occur between the socio-institutional sphere and the new paradigm. This transformation is a gradual process, slowed down by institutional inertia (Perez 2009, 15). Various social groups resist radical change, such as the owners and shareholders of old industries, labour unions and workers, or politicians. As the techno-economic sphere is assumed to evolve faster than the institutional environment, "*structural crises of adjustment*" (Freeman and Perez 1988) or "*mismatches*" (Perez, 2009, 16) emerge between the two spheres. Contradictions emerge between the institutional environment tailored to suit the "old" paradigm and the "new" paradigm with new opportunities and risks. That transition period is characterized by uncertainty, creative destruction, recessions, and crises; new institutions have to be developed and tuned by trial and error. Regulatory and institutional adjustments need time to catch up with the technological innovations. It can take decades until a new match is achieved, resulting in a new surge of stability and economic growth.

While Freeman and Perez do not specify how structural crises, mismatches or decoupling processes happen in detail, Tylecote (1994, 484) distinguishes between three types of mismatch that can occur in the TEP model: Type 1 is a microeconomic mismatch. It occurs when the diffusion of new technology is obstructed from the start, for example if the organization of a firm is unsuited to the new paradigm. This type slows down the diffusion-speed of the new paradigm. Type 2 is a macroeconomic mismatch. As the new paradigm diffuses, imbalances develop, resulting in a macroeconomic crisis. An example cited by Tylecote is the growing income inequality as seen in the United States in the 1920s and generally in the 1980s; that prevents the required expansion of consumer demand and is ill-matched to the new style which tends to demand more equality. Type 3 is a socio-political mismatch. A socio-political crisis arises when the successful diffusion of the new paradigm causes conflicts between different groups of society. Tylecote mentions the situation in Germany before 1914 as an example, but one also can think of conflicts between labour and capital. Type 3 also has an international variant.

Structural crises vary in duration, severity and implications. In this regard, evolutionary explanations of economic development have stressed the importance of deep-seated recessions and periods of adjustment that terminate old and begin new 'long waves' of economic development. In Freeman and Perez's (1988) terminology, these long waves are 'techno-economic paradigms (TEPs) that may last 50 years or so, comprising both long periods of upswing and downswing. Crisis occurs when the old paradigm, and its underlying the techno-economic and socio-economic characteristics, becomes obsolescent, and new 'paradigmatic' technologies start to exert pervasive effects in all economic sectors in association with new policies and institutional arrangements. Indeed, because new TEPs have pervasive effects, changing "*the skill profile and capital stock throughout the system ... periods like the 1930s and 1980s cannot be treated in the same way as the minor recessions of the 1950s and 1960s*" (Freeman and Perez 1988, 62). Such recessions define turning points in economic evolution that confirm declining productivity in the old paradigm while heralding the need to incorporate new technologies and matching institutional practices. From this perspective structural change and crisis are connected. It is hard to imagine that business, governments and labour would be willing to engage in comprehensive restructuring without the motivation of severe crisis. Moreover, recessionary turning points become longer periods of structural adjustment and volatility because of resistance by vested interests; matching policies are unclear and require experimentation that may not be successful; and new rapidly emerging industries themselves may overshoot and face shakeouts (Perez 2010). Social and political unrest, for example as manifested in labour struggles, that pulses with long waves further underscores the contested nature of restructuring. Freeman and Perez recognize social unrest and conflicts that are rooted in organizational inertia, "*a well known phenomenon of human and social resistance to change*" (Perez 2010, 198), but their analysis of the relationship between long waves and unrest is limited in scope, and to labour. There are other forms of social protest that in resource regions, for example, relate to environmental and cultural conflict. In addition, conflict may arise from direct opposition to a TEP – interests that are marginalized – as well as from paradigmatic change itself.

Using the TEP model in the context of this thesis has several limitations. First, it is a macroeconomic framework anchored at the national scale, focussing national innovation systems. Freeman and Perez acknowledge variations in the model due to social, cultural, historical or political factors, but they do not make any predictions about regional variations and outcomes at other geographical scales. Even though, some important geographic implications can be derived from the TEP framework. As most industries are not evenly distributed across space, the emerging of a new paradigm is spatially uneven, creating new economic cores and new peripheries.

Second, the model was developed for secondary manufacturing industries in the economic core, both within national states and at the global scale. The model does not make predictions about the processes at work in resource industries at the periphery. However, the shift to a new paradigm, new industries and new inputs implies strong implications for resource peripheries.

Third, the TEP framework stresses innovation and long-run technology change. Crises and recessions are part of the model not the major focus and the idea of mismatches between techno-economic and institutional structures is not fully explained. Nevertheless, the idea of mismatches as a cause of structural crises of adjustment is intriguing and provides a perspective on economic crisis that is not considered in the conventional, neoclassical theories.

Indeed, the model provides some valuable insights about recessions and crises. First, a mismatch can occur at multiple scales. Tylecote (1994) mentions the firm level, the national economy and the international level, but there is no reason why a crisis could not also occur at other scales, such as a regional or industry level mismatch. Second, a recession is not caused by a single explanatory factor, but by a constellation of co-evolving factors. In such a view, a crisis appears as a struggle of multiple forces, partly rivalling, partly allied and subject to path dependence and inertia, meeting at multiple geographical scales. The TEP model also implies that (some) economic crises act as turning points.

2.4 Recessions as Turning Points

Although it is established that recessions and restructuring are deeply intertwined, the causal relationship between the two is not entirely clear. It remains uncertain what is the cause and what the effect, whether a recession encourages or obstructs restructuring.

The idea that recessions stimulate restructuring is supported by Schumpeter and Mensch and goes back to Juglar (Dal-Pont Legrand and Hagemann 2007). In this view, investors will restrain from risky long-term ventures (innovations) during periods of general prosperity, whereas during periods of stagnation or recession they are more willing to undertake new projects (see Mensch 1979). In such ways, a recession also acts as selection mechanism for firms and their chosen technology, organization structure and strategy; only healthy and innovative firms will survive the crisis. Therefore, recessions are beneficial from an evolutionary perspective; they pressure capitalists to improve their organization and to introduce new technologies, which are the two main strategies to overcome the crisis. Thus, despite the low or even negative growth rates, a recession period contributes to long-run economic growth.

In Perez' (2002; 2009) view, restructuring can cause recession. A new, emerging technology constitutes a small, but rapidly growing segment of the economy. Financial capital, seeking for high returns, targets this economic segment for investment. That typically happens during a period of stability and relative prosperity, when most capital is bound in production, yielding consistent but average returns. The investment in a new technology at high risk but with prospects to high returns successively leads to a speculation bubble, which eventually bursts, resulting in a recession. Prominent examples quoted by Perez are the British railway mania that resulted in a major crisis in the mid-19th century, the roaring twenties that led to the 1929 economic crisis or more recently the internet mania of the 1990s peaking in the 2000 recession.

Those examples demonstrate that the relationship between recession and restructuring is ambiguous and the question remains whether an economic crisis stimulates or obstructs restructuring. From a firm's perspective, the signals for restructuring sent by a recession are contradictory. Declining profit rates and dire business prospects during a recession provide incentives for a firm to look for alternative markets, products or modes of organization. Firms may take advantage of an economic crisis to take over financially stricken competitors and expand into new business lines.

Likewise, during an economic crisis rationalization measures, such as layoffs and plant closures, are likely to meet less resistance from unions or communities.

On the other hand, a firm might fail to recognize the need for restructuring. This is especially the case in a resource context in which sequences of boom and bust are a regular experience. During a recession, most industries move into a state of paralysis or hibernation rather than bustling activity. Shifts are curtailed and factories are shut down temporarily to re-open after the crisis. Recessions imply a focus on the short-term, especially on saving and cost cutting. Such behaviour is not always conducive to long run planning and strategic adjustment. Even if firms are well aware of the necessity for restructuring, an economic crisis might severely constrain their capability to invest and adapt (see Hayter 2000, 97f). Restructuring comes at substantial cost. New investment projects need substantial financial resources that are not at disposal in times of crisis. Employment reduction requires severance payments and early retirement costs. In addition, layoffs decrease the knowledge and experience available within the firm, thus discouraging new ventures. In-situ restructuring includes the cost for new equipment and the foregone profit while the factory is rebuilt. Even plant closures come at a cost, as considerable sums have to be paid for environmental cleanup, asset write-down and demolition. Finally, path dependent behaviour and the lock-in into certain markets, organizational routines and thinking processes might considerably restrict a firm's ability to restructure and encourage the decision-makers to resist radical change.

Thus, the effects of a recession are ambiguous and hard to predict. Most likely, both arguments – a crisis stimulating or protracting restructuring – are justified and true at particular times and places. In sum, not all recessions are turning points; while some of them stimulate fundamental restructuring processes, others do not seem to have a lasting effect. The important question remains: what makes a recession a turning point? In this regard, it might be expected that the industry life cycle model might shed light on this question.

2.5 Industrial Evolution and the Industry Life Cycle Model (ILCM)

Industries follow a life cycle that usually takes the form of a Kuznetzkian dynamics (see Ayres 1997). The importance of an industry (for example. measured by employment or sales) over time follows an inverted U-shaped curve. An industry goes through four different phases: pioneering, growth, maturity, and revival/decline (figure 2.1). Those stages are not sharply delimitated but characterized by gradual changes regarding sales (both dimension and growth rate), firm size, and the number of companies entering and exiting the market. The duration of each phase varies in time across industries, lasting from a few years to several decades. There are a number of features inherent to the industry life cycle that imply substantial restructuring of an industry over time (see Abernathy and Utterback 1978; Dosi et al. 2008; Griliches 1957; Klepper 1996; 1997; 2002; 2010; Klepper and Graddy 1990; Utterback and Abernathy 1975; Utterback and Suarez 1993).

First, the number of new entrants into an industry eventually declines. During the final stages of the cycle the number of exits tends to exceed the new entries. However, this reduction in firm numbers does not have to result in a declining output. In a maturing industry the shrinking number of firms is likely to result in an oligopolistic structure (Klepper 2002).

Second, most industries are subject to a shakeout of firms. Klepper and Millller (1995, 567) define a shakeout as "*substantial entry and a sharp increase in the number of firms [...] followed by a lengthy period in which there was a persistent fall in the number of firms despite continued growth in output*". Such a shakeout has been found in most industries, although the time when it occurs differs between industries (Gort and Klepper 1982; Klepper and Graddy 1990). It is more likely to appear in early stages of development, but can occur in mature industries (Bergek et al. 2008). There are two main causal explanations for a shakeout. First, growth perspective in an industry can attract numerous entrants and lead to excess entry. In the following, intensified competition leads to a massive exit of firms (Aaker and Day 1986; Bertomeu 2009). A second explanation is associated with the shift from product to process innovation. As firms increase production to exploit internal economies of scale, eventual oversupply leads to dropping prices and eventually to a shakeout (Utterback and Suarez 1993).

Innovations and changing technology are likely to play a key role (Klepper and Simons 2005).

Third, over time, the focus shifts from product innovations towards process innovations. While product innovations steadily decline, process innovations peak at some point during the cycle and decline from then (Utterback and Abernathy 1975). Product variety declines over the cycle as a dominant design emerges. That search for a best practice implies processes of trial and error, in which unsuccessful firms either adjust or exit. Eventually this results in a rationalization of production.

Those findings imply that strong restructuring processes taking place over the life cycle of an industry, happening both through a substantial turnover of firms (entries and exits) and the adjustment and adaptation of firms. Most work on the industry life cycle focuses on the early or intermediate stages of the cycle. A neglected research topic is what happens towards the end of the life cycle, once a firm or an industry reaches the stage of maturity. The notion of a “life cycle” implies the eventual “death” of an industry. Yet little is known about how this “death” occurs, whether as a sudden breakdown or a gradual decline. Given an industry’s capability of adaption, innovation, and industrial learning (see Lundvall 1992) substantial resilience is likely. Analogous to the product life cycle (see Cox 1967; Dean 1950; Levitt 1965; Vernon 1966) it is possible that firms revitalize an industry, for example by creating new markets, new products, new marketing methods, government subsidies, or the exploitation of sub-markets (see Proctor 2001, 201).

ILC-research is strongly biased towards secondary manufacturing industries situated in the core. In his comprehensive review of existing works, Peltoniemi (2011) reviewed 216 studies about industry life cycles. Without exception, they are limited to secondary manufacturing industries and not a single reference is made to primary manufacturing or resource industries.

Not a lot is known about the connections between recessions and the industry life cycle. There is plenty of work investigating the effects of business cycles on firm entry and exit rates (for example Caballero and Hamour 1994, see Gil (2008) for a review). It is established that the number of firms varies over the business cycle in a pro-cyclical way, but hardly any reference is made to the industry life cycle. Industry life cycle research on the other hand attempts either to find evidence for a cyclical dynamics from the data, such as Abernathy and Utterback, or to design deductive theoretical models that can produce such a cyclical pattern, such as Klepper. In either case, they are concerned with the regularities, the cyclical pattern, rather than fluctuations.

In response to these two shortcomings of the ILCM, Clapp's (1998) resource cycle thesis and the ILCM are combined as the Resource Industry Life Cycle Model (RILCM) to provide a template for incorporating booms and busts in the particular context of resource industries and peripheries.

2.5.1 The Resource Industry Life Cycle Model (RILCM)

Conceptually, in their basic formulation, the ILCM and Clapp's (1998) resource cycle thesis summarize industrial evolution in terms of life cycle processes expressed as birth (pioneering), growth, maturity, and decline in the former case and discovery, growth, plateau effects, decline, and collapse in the latter case. While Clapp noted boom and bust cycles as part of the reality of resource industry trajectories, his interests focus on questions related to resource depletion and exhaustion. Neither model directly explores the impacts of business cycles for industrial behaviour. The Resource Industry Life Cycle Model (RILCM) combines the ILCM as a generic template of industrial dynamics with the peculiarities of resource exploitation and a basis for assessing the implications of volatility.

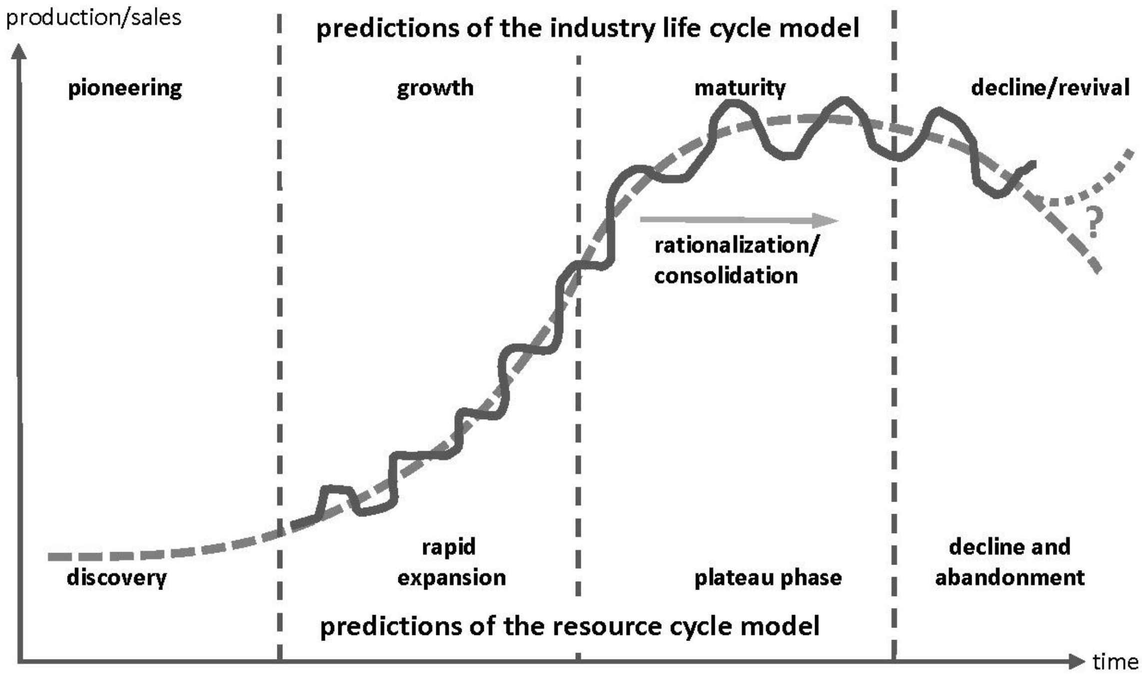
Perhaps the neglect of interest on subsequent shakeouts as industries mature during the ILCM reflects a focus on contemporary forms of development and an assumption that in later stages growth levels off and declines because of technological change, market saturation, competition from elsewhere, and the development of new 'substitute' products. Yet maturity can last for extremely long periods, and as the pioneers of the ILCM pointed out, technological change can rejuvenate as well as undermine established industries (Abernathy and Utterback 1978). Moreover, a major contribution of recent evolutionary studies in economic geography has been to reveal the significance of the forces of localization that shape employment pools, knowledge transfers, firm-supplier relations, networking, and capital inertias in industrial trajectories, and how the structures and scope of agglomerations or clusters change over long periods of time in ways that involve shakeouts and new forms of growth, not associated simply with aging (Li and Bathelt 2011; Martin and Sunley 2011; Potter and Watts 2010). Moreover, if not labeled as shakeouts, studies of plant closure and components of (employment and plant) change were important to investigations of the restructuring of old industrial agglomerations in the context of the 1980s recession (Stafford and Watts 1990; 1991; Watts and Stafford 1986).

In the elaborations and criticism of the ILCM resource industries are scarcely mentioned let alone distinguished. As a template, the ILCM clearly has relevance for the RILCM. The pioneering and rapid growth stages of many resource peripheries feature competitive entrepreneurial regimes that give way to vertically and horizontally integrated corporations as firm and factory level economies of scale become more significant. Although resource activities are usually classified as low or medium-tech, as measured by R&D intensities, innovation and technical change are vital sources of efficiency, and innovation is increasingly process-oriented. The RILCM also anticipates decline and abandonment, bearing in mind that periods of maturity and decline can be extremely long, punctuated by various forms of rejuvenation and survival strategies, as technical change can redefine the size of resource sites, increase processing efficiencies, and contribute to value added product differentiation and quality enhancement.

Notwithstanding these points of overlap, the RILCM model is profoundly distinguished from the ILCM because of its reliance on the direct exploitation of nature. For the industry, resource depletion imposes increasing supply costs and the plateau stage refers to significant turning points in resource availability, while for society resource depletion directly imposes negative local and global externalities in the form of biodiversity loss, climate change, challenges to traditional practices and values, and concerns for aesthetic sensibilities. Further, if clustering dominates geographical interpretations of the ILCM, the dispersion of resource industries to wherever nature provides resources is a reminder of the powerful centrifugal as well as centripetal effects of economic development. The dependence on exports to distant core markets, often in remote places, renders many resource activities unusually sensitive to business cycle fluctuations. The tendency of core regions to develop diversified sources of resource supply, and to protect domestic resource interests, reinforces this sensitivity. Moreover, plateau effects, and any growing concerns over non-industrial values further complicate business cycle impacts on the RILCM. However, apart from references to the Dutch Disease as it relates to resource booms, the long run implications of booming and busting for industrial behaviour or regional development are largely ignored in broad contemplations of the evolution of resource industries and communities; such as the classic statements by Freudenburg (1992) or Watkins (1963) on North American experience, or even Zimmerman's (1972) classic treatise, and in recent insightful commentaries (Hanink 2002; Hayter 2008a).

According to the RILCM, a period of exploration, discovery and initial production is followed by a rapid, booming growth during a 'lengthy' period of upswing (Figure 2.1). In general, resource booms are encouraged by low costs and abundance of resources, strong inter-firm rivalry, and the interests of core markets in obtaining cheap large volume supplies of resources that dovetail with motivations of peripheries in exploiting resources endowments for economic development and making them available at low cost. Resource booms are further facilitated by investment in increasing large-scale operations and/or by extensive entrepreneurial participation, that are required to justify substantial fixed costs in economic and social overhead capital, especially transportation networks and community infrastructure, and machinery and equipment. However, competition to gain access to new resources can stimulate over-production at least in the short run. In those activities dominated by entrepreneurial structures, entry barriers are typically low. However, in many if not most resource sectors firms are typically large due to the required substantial capital investment and significant scale economies. Operations in new resource peripheries easily established, especially if associated with private property regimes that are hard to restrict by government policy. In resource cycles dominated by vertically and horizontally integrated MNCs, driven by economies of scale, size, and growth, individual investments typically add large increments to supply while desires to control and stabilize large volume commodity movements between affiliated operations encourages multiple investments among MNCs in resource booms, even at the risk of industry-wide over-supply.

Figure 2.1 The resource industry life cycle model (RILCM)



Source: author’s graphical representation

In the RILCM, during resource upswings and into maturity recessions occur as temporary fluctuations around the trend of growth and stability, without strategic implication for industrial or social behaviour and policy. Rather, resource communities become “*addicted*” (Freudenburg 1992), regions “*trapped*” (Watkins 1963), and poor nations “*cursed”* (Auty 2001) by their resource riches. For Auty part of the puzzle of this paradox is provided by the Dutch Disease hypothesis that argues that resource booms inflate domestic exchange rates increasing the costs of more diversified forms of development. From local perspectives, as Polese and Shearmur (2006) argue in a Canadian context resource booms generate high wages (and increase land costs) creating barriers to the formation of new businesses, further challenged by limited market potentials and remoteness. Typically, resource towns are also highly specialized and unionized, another unattractive feature to small business, while unions and local communities in general have no interest in encouraging alternative low-waged activity. They too prefer addiction to the high incomes typically generated by resource industries, and to wait for these incomes and full employment to return on the next upwards bounce. Regionally, addiction is reinforced by expensive public infrastructure that is dedicated to resource exports and supportive government policies and rhetoric (Gunton 1998; Watkins 1963). Resource regions and communities themselves, with specialized labour pools and infrastructures, may have little inclination to diversify in the context of the experience of normal recessions.

In tandem, the path dependent behaviour of vertically integrated resource corporations is highly constrained, addicted to its dominant strategy. Thus such integrated resource firms utilize technologies that are "*based on process rather than science or product and are not readily transferable. Large size implies the scale of investment in new business must also be large […] train few generalists […] and the organization structure they preside over tend to inhibit strategic change*" (Rumelt 1974, 139). Moreover, to compete with equally large rivals, integrated resource corporations need to invest continually in expensive harvesting/mining and processing sites, even when the rates of return on investment are low from shareholder perspectives (see Watkins 1963). The international scope of giant integrated firms further reinforces this commitment. As Rumelt summarizes "*like the poker player who has so far matched the bests of others, the integrated business keeps reinvesting because although winning is improbable, loss is certain if it does not*" (Rumelt 1974, 139). Like resource communities, vertically integrated resource corporations are addicted and trapped by their core competencies and costly assets. According to the RILCM, however, resource exploitation contains an internal dynamic of self-destruction and as growth levels out in the plateau stage decline and closure become possibilities. This anticipation is most readily appreciated in regards to non-renewable resources, and highlighted by debates over peak oil (Campbell and Laherrère, 1998). As Clapp (1998) emphasizes, however, industrial exploitation progressively depletes renewable resources in quantity, quality, and accessibility providing built-in tendencies towards increasing material supply costs and decreasing material supply availability. Thus in fisheries and forestry, plateau effects and decline – respectively collapses and falldowns – have been widespread around the globe, and technologies that permit exploitation of inaccessible and lower quality resources are typically very expensive, and may delay but not eliminate questions of slow growth or even decline. Renewal schemes rarely if ever anticipate declines in depleting nature's providence while replacement resources (farmed fish, plantation wood) are never the same as the original. Moreover, as supply costs rise with exploitation, competition from new resource regions, not to mention substitute products, dampens prices leading to cost-price squeezes as resource industries mature (Freudenburg 1992).

In the context of the RILCM, it is reasonable to expect some causal relationships between plateau effects and turning points. After all, resource booms are driven by the demands of economic development and once resource regions come into play, economic and social imperatives relentlessly push rates of depletion. All kinds of considerations may modify the association between resource cycles and more general long waves. The trajectories of individual sites may not fit neatly into a broader regional sequence; technologies can bring back long dormant resources while corporate discretion and politics may lead to closure in advance of plateau effects. Nevertheless, especially at regional scales, resource booms and declines are themselves an integral part of long waves.

Turning point recessions, however, are uncertain, even ambiguous contexts for restructuring RILCMs. Thus, such crises directly confront path dependent behaviour and raise serious questions about continuing established strategies and routines. For conservative resource based corporations, long used to low returns, change is especially difficult to contemplate while conventional cost-cutting and survival responses to recessions are not necessarily consistent with the most appropriate long run strategies. Plateau effects can add ambiguities in turning point recessions. Thus, even for non-renewable resources such as coal and oil, estimates of resource availability and economics are themselves uncertain and a basis for conflict among business, government and labour interests, especially when social costs and benefits are incorporated (Hudson 1978, 109). Moreover, for local resource communities, labour and some firms, having long experienced normal recessions, the long-term consequences of turning point recessions may take some time to appreciate.

The relationships and implications of the RILCM and long waves, specifically between plateau effects turning points, vary over time and space. Historically, the Fordist boom decades from the late 1940s to the 1970s massively escalated demands on natural resources; the 1980s recession occurred as many resource regions had matured and were approaching the plateau levels of the resource cycle, at the same time as traditional core industrial regions were de-industrializing. The flexibility imperatives associated with the transformation from Fordism to the ICT embraced resource industries and peripheries as they faced sudden declines in demand for their commodities and with emergent with long-term supply side problems. At the same time, Fordist resource booms stimulated escalating fears for the non-industrial values of resources, led by environmental non-government organizations (ENGOs) and concerns over cultural identity, especially among Aboriginal peoples still surviving in peripheral regions. From this perspective, the proliferation of resource wars around the globe, and the increasing contestation of resource peripheries development, is rooted in institutional clashes representing the industrial and non-industrial values of resources. For resource industries restructuring has implied new resource bargains that have both restricted and constrained industrial exploitation (Affolderbach 2011; Clapp et al. 2011). Geographically, RILCMs comprise a highly variegated category of 'local models', geographically contingent shaped by distinctive resource endowments, situations, histories and policies, and particular mixes of global-forces (Barnes 1996; Barnes and Hayter 2005).

Neither business cycles, nor the long waves, nor the industry life cycle explicitly include a regional perspective. However, much can be gained from viewing recession and restructuring within a regional frame. As firms and industries are embedded in a regional context, their rise, restructuring and decline has immediate effects on the regions in which those industries are located.

2.6 A Local Model of Recession and Restructuring

Based on the literature reviewed in this chapter, several conclusions can be drawn about recessions and restructuring in resource regions. First, different explanations for a recession are stressed in the literature, such as economic 'shocks', technological innovations, capital investment, or institutional evolution and inertia. Therefore, a monocausal explanation for crises is unlikely and it can be assumed that recessions have multiple causes and emerge out of different constellations of economic and institutional factors.

Second, recessions include 'structural crises of adjustment' or 'mismatches' that occur at different geographical scales. Those mismatches can be understood as conflicts, contradicting values, beliefs, and routines that arise from the co-evolution of economic and institutional factors and the contrarian forces of resistance and inertia. Such mismatches can manifest within firms, industries, regions and national economies.

Third, recessions are unique, place-specific, and path-dependent. Each recession emerges out of a particular constellation of economic and institutional forces that are unleashed in an uneven way across space and geographical scale. Those forces are interdependent and subject to their own evolutionary dynamics, which implies that also recessions are path-dependent phenomena.

Fourth, recessions can both encourage and obstruct restructuring. The outcome for a particular firm or industry depends both on the nature of the recession (i.e. the particular constellation of economic and institutional forces that it is rooted in) and on the stage in the life cycle of the industry. Thus, multiple outcomes are possible for different regions and industries. Booms and busts also raise questions about resilience (Bristow 2010; Christopherson et al. 2010; Pike et al. 2010; Simmie and Martin 2010), for instance whether crises lead to more or less resilient regions and industries.

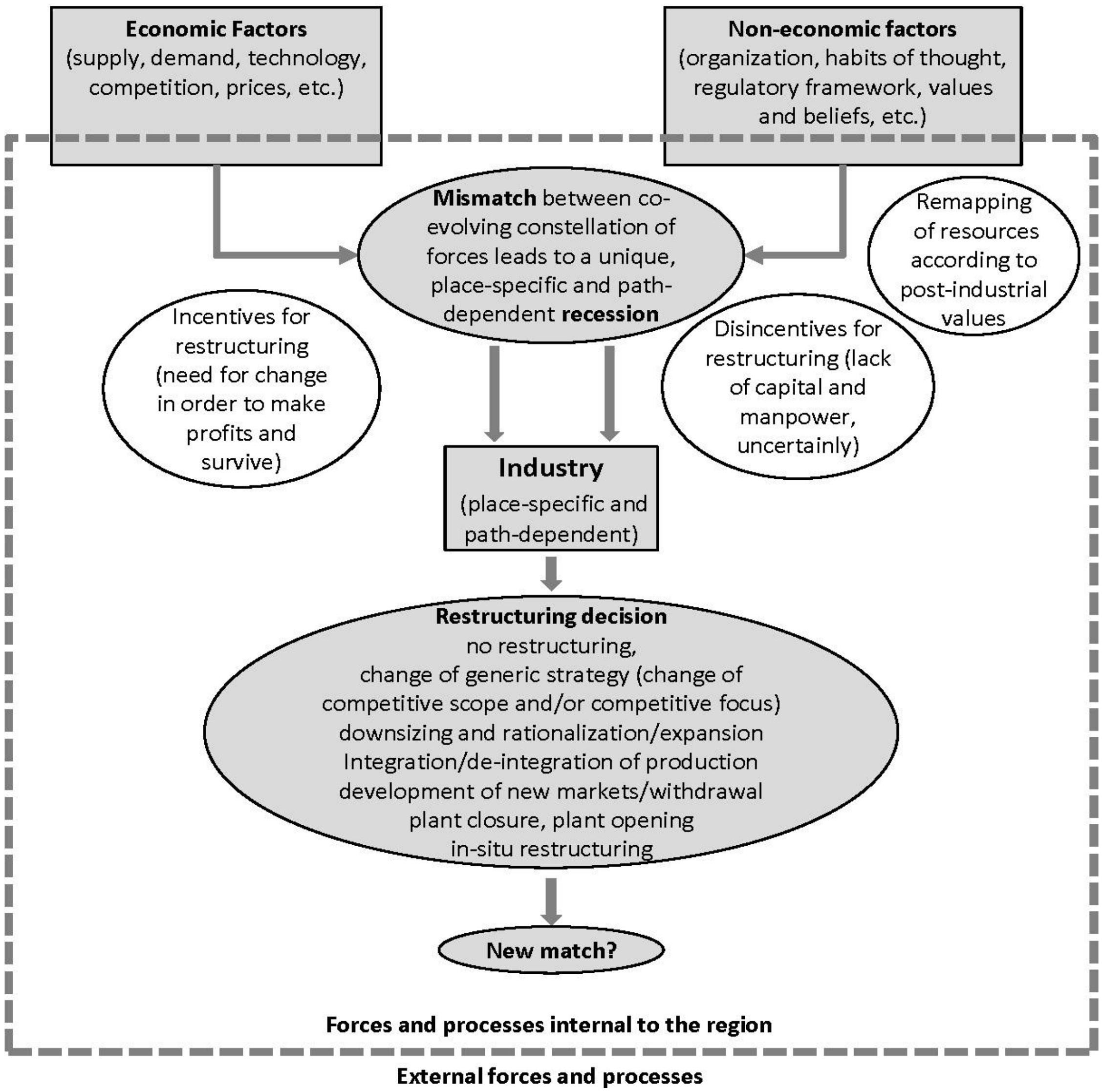
Those findings have important consequences for the framework used in this thesis. Even though the theories of recessions reviewed above are different in origin and focus, they share an important common feature: all of them are global or universal in their concept; they focus singularities and common features of economic crises and attempt to explain them with general and unifying theories. This is true for both neoclassical business cycle models, long wave theories and the industry life cycle.

However, while recessions may have many features in common, the evidence collected so far illustrates that an economic crisis has multiple sources, such as market conditions, technology, capital, or institutional factors. Likewise, a recession has multiple outcomes. Thus, both origin and outcome depend on the nature of the individual crisis. Recessions might share some common and measurable motions of economic variables, but they are caused by a unique, place and time-specific constellation of institutional and economic forces. For that reason, it might be worthwhile to treat each economic crisis in a unique and individual way rather than keeping on searching for a universal model. Although it is certainly helpful to analyze what economic crises have in common, such an approach obstructs the view at the individual recession and comes with the dangerous temptation to ignore its particularities. Instead, the questions to be asked about economic crises are: What makes this particular crisis special and different? What constellation of economic and institutional forces did it emerge from? What are the outcomes for a particular industry in a particular region?

Therefore, this work calls for a “local model” of economic crisis. As opposed to global or universal models that represent the essential relations underlying the world, local models emphasize path-dependent, place-specific constellations of institutional actors that can yield quite different outcomes in a different geographic context (Barnes and Hayter 2005). Furthermore, local models recognize the importance of both economic and non-economic factors. In the context of this work, the incorporation of both economic and non-economic factors is not only justified but also necessary. As Barnes and Hayter (2005, 467) state, *"[i]n resource peripheries, the 'economic' can only be properly understood by explicit inclusion of political, environmental, and cultural forces*".

One such framework for a local model of recession and restructuring is represented in figure 2.2. A recession is driven by the co-evolution of economy, technology, and institutions. The co-evolution of those factors leads to a mismatch that can occur at various geographical scales, both internal and external to the region. Such a mismatch is path-dependent and unique, that means it emerges at a specific point in time out of a specific combination of forces. Each mismatch is also place-specific as the constellation of forces manifests differently at different locations. A mismatch results in a recession that sends ambiguous signals to the industry. On the one hand there is pressure to change and adapt in order to remain profitable; on the other hand, a recession leads to uncertainty and lack of capital for investment. Those signals are interpreted differently by firms in different places and at different stages of their life cycle. Based on that signals and its individual situation, a firm makes a decision about restructuring, choosing between a variety of available strategies, applied either isolated or in combination.

Figure 2.2 A local model of recession and restructuring



Source: author's graphical representation

3: BOOMS AND BUSTS AS ROUTINE: KEY TRENDS IN BC'S FOREST ECONOMY 1946-2010

3.1 Introduction

Beginning in the 1970s, the increasing contradictions of the Fordist TEP among leading western economies were reflected in a change from stable and predictable business conditions towards volatility and uncertainty, involving several economic crises and intermittent periods of rapid growth. This volatility is acutely revealed in BC's forest economy, precisely when its evolution reached the plateau stage of the RILCM. Indeed, this 'plateau' takes the form of a series of mountains and valleys rather than a well-weathered tabletop. Building on the concepts discussed in chapter 2 this chapter argues that the prolonged volatility experienced by BC's forest industries is the result of a process of structural adjustment generated by the dynamics of RILCM, business cycles, and the search for matching industrial and non-industrial institutions and values.

The chapter is in four main parts. The first section provides an overview of key trends in BC's forest economy from 1946 to 2010 and highlights the 1980s recessionary crisis as a turning point. The second part (section 3.3) analyses timber harvest and utilization. Third (section 3.4), time series of a variety of key industrial variables are presented to reveal three distinct periods: stability with high growth and low volatility during Fordism (1946-1970), a phase of high growth with increased volatility from the 1970s on that culminated in the recession of the early 1980s, and a period of stagnation in connection with high volatility that started after the 1980s crisis. The fourth part (Section 3.5) briefly notes the barrage of policy initiatives that have sought to re-regulate and at least in part to stabilize the forest industry.

3.2 Overall Dimensions of Change 1946-2010: Towards Crisis and Volatility

The overall trend in the evolution of BC's forest economy from 1946 to 2010 is statistically summarized by the production of sawn lumber, the biggest forest industry and closely tied to the log harvest. The series is sensitive to business cycles and a good proxy for the overall activity of BC's forest industries (figure 3.1). It is measured by volume and therefore not distorted by inflation. In order to reduce the impact of seasonal fluctuations, a 12-point moving average was calculated.

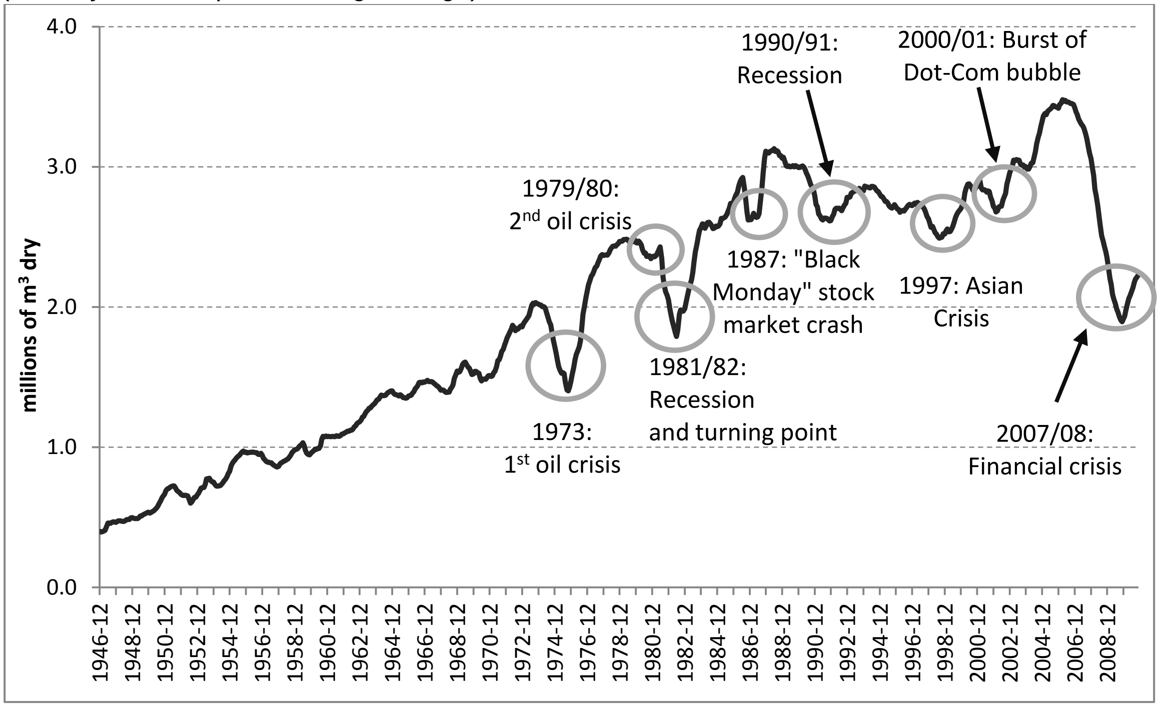
Two features are evident in the time series. First, lumber production was subject to a growing trend from 1946 that peaked in the late 1980s and eventually levelled off. Second, volatility (fluctuations around the trend) increased from the 1970s on. In such ways, three distinctive periods become apparent, set apart by different regimes of growth and volatility: High growth rates and low volatility characterized the Fordist period from 1946 until the early 1970s. While harvest levels fluctuated to some extent, major crises or recessions were absent[4]. The "winds of change" started in the 1970s and cumulated in the 1980s crisis that was the big turning point for the forest industries. Growth rates remained high while volatility increased considerably.

From the mid 1980s on, growth rates started to decline and even became negative in the 1990s, indicating a shift of the industry from growth to maturity. Volatility remained high due to a series of recessions and crises. The 2000s brought a boom in harvest rates, fed by a strong US housing market and the recovery of dead timber killed by the mountain pine beetle. This boom was followed by the devastating recession of 2007.

[4] The short recession of 1958 had no lasting impact on US demand and thus neither on BC's forest industry.

Figure 3.1 BC, sawn lumber 1946-2010

(Monthly data, 12-point moving average)



Data: Statistics Canada, CANSIM series v1766

From the 1970s, BC's forest industry experienced eight recessions, evident through a sudden decrease in lumber production. The 'immediate' cause of fluctuations, at least for lumber and plywood, relates to the housing market in the US. In fact, the general 'immediate' cause of recessions is market downturns. Thus, six of those recessions coincided with recessions in the US as defined by the NBER (table 3.1). The US is the largest market for BC wood products, especially lumber, and the US housing market is the main driver of export demand for BC lumber exports. In seven cases, the declining timber harvest corresponded with a considerable downturn of the US housing market.

The only exception is the 1997 recession that was triggered by the Asian Crisis, when Japan was BC's second largest market for wood products. As a basis for understanding these statistical trends it is first necessary to briefly examine how forest policy and business organization evolved historically especially during the Fordist period.

Table 3.1 Major crises in BC's forest economy 1970-2009

US recessions (NBER definition)			US housing starts (12-point MA)			BC sawn lumber (12-point MA)			Reasons for recession
Peak	**Trough**	**GDP decline[1] (%)**	**Peak**	**Trough**	**Decline (%)**	**Peak**	**Trough**	**Harvest decline (%)**	
NOV 1973(IV)	MAR 1975 (I)	-3.2	NOV1972	JUL 1975	-54.6	OCT 1973	OCT 1975	-31.1	Increasing oil prices
JAN 1980(I)	JUL 1980 (III)	-2.2	NOV 1978	NOV 1980	-36.6	NOV 1979	NOV 1980	-5.5	Increasing oil prices in 1979; tight US monetary policy to control inflation
JUL 1981(III)	NOV 1982 (IV)	-2.6	MAY 1981	JUN 1982	-31.6	JUN 1981	JUN 1982	-26.3	Raised interest rates to control inflation
(*no recession according to NBER definition*)			SEP 1986	NOV 1988	-19.6	JUL 1986	MAY1987	-9.8	"Black Monday", 1987 stock market crash
JUL 1990(III)	MAR 1991(I)	-1.4	JAN 1989	NOV 1991	-33.4	MAR 1990	NOV 1991	-13.1	Oil price shock, savings and loan crisis, consumer pessimism
(*no recession according to NBER definition*)			(*no decline*)			APR 1997	AUG 1998	-9.3	Asian financial crisis
MAR 2001(I)	NOV 2001 (IV)	+0.7	FEB 2000	SEP 2001	-3.2	FEB 2001	MAR 2002	-7.3	Collapse of dot-com bubble
DEC 2007 (IV)	JUN 2009 (II)	-4.1	MAR 2006	DEC 2001	-73.4	OCT 2006	NOV 2009	-45.1	Subprime mortgage crisis; burst of US housing bubble

[1] GDP is measured in 2005 US$. GDP decline was calculated using quarterly data, as indicated by the Roman numerals in brackets.

Source: recessions: NBER (www.nber.org); housing starts: US census bureau (www.census.gov); sawn lumber: Statistics Canada, CANSIM series v1766

3.2.1 Fordist Prelude

The foundations for an unprecedented Fordist expansion of BC's forest industries were laid in the late 1940s. The 1945 Royal Commission, conducted by Chief Justice Gordon Sloan, introduced the concept of sustained yield (SY) that was defined as "*a perpetual yield of wood of commercially usable quality from regional areas in yearly or periodic quantities of equal or increasing volume*" (Sloan 1945). SY was instituted to cope with two large challenges that BC faced: first, to develop the vast, sparsely populated hinterland and to create employment throughout all regions of the province, second, to provide the growing forest industries with an abundant supply of raw materials. SY guaranteed steady tax flows and permanent payrolls for forestry workers (Hagerman et al. 2009). The key Forest Policy Amendments made in 1947 to the Forest Act of 1912 anticipated the development of BC's forest economy along Fordist lines. The forest sector was deemed a major engine for growth that could be best organized by large corporations that could ensure stable and sustained development by providing expertise and access to markets and sources of finance. The provincial government created tree farm licenses and other forms of tenure that provided firms with large areas of timber over relatively long periods of time, typically for 25 years and renewable, in return for large-scale investments in the forest industries, including pulp and paper mills

In the following decades, British Columbia experienced "*one of the most thorough Fordist experiments in the capitalist world"* (Young and Matthews 2007, 178). From 1945 to 1970, employment in forestry grew threefold and output levels even faster (Hayter 2000, 58). Social Credit, which had close ties to the forest industry, was in power from 1952 until 1972 (and again from 1976 to 1991) ensuring political continuity. 'Big' government and big business, supported by big labour, dominated forest policy (ibid. 49) and forged what Wilson (1987/88, 7) called the wood "*exploitation axis*". A free trade agreement guaranteed unlimited access to the US, BC's largest export market. Because BC's forest economy was driven by exports and foreign direct investment, its version of Fordism can be labeled as 'permeable' (Jenson 1989).

During the years of the long Fordist boom institutions were tailored to match the need of an export-based commodity driven large-scale forest industry. A province-wide transportation infrastructure was created to improve access to remote regions. New resource settlements were established, such as Gold River and Mackenzie, and existing communities that had good access to fibre and transportation were expanded. In broad geographic terms, Permeable Fordism in BC's forest economy developed around a strong core-periphery structure. Resource production was dispersed throughout the province, and supported by regulations and requirements, including appurtenancy, which required timber to be processed in the region of its harvest. "Utilization requirements" demanded the harvest of a wide range of different wood species. Minimum annual harvests guaranteed stability of employment and timber supply; holders of TFLs were required to utilize volumes equal to the annual harvest issued under the license over relatively short periods. Metro Vancouver remained the biggest wood processing centre and the main export point, while attracting headquarters of big corporations plus various R&D functions.

While the Coastal region had been the historical centre of activity, forest product activities diffused throughout the Interior after 1950. In the periphery production concentrated in the more accessible communities, including integrated forest product complexes such as Port Alberni, Powell River and Campbell River on the Coast and Prince George and Quesnel in the Interior.

Forest policy clearly favoured large integrated firms as the key organizers of BC's forest economy. Policy guaranteed planning certainty, stability of timber supply, and the access to vital export markets. By 1970, a handful of corporations controlled significant shares of the production of the main forest product commodities – lumber, plywood, shingles and shakes, pulp, paper, paperboard, and converted paper products. These firms did much of their own logging, allocating timber supplies sorted by size and species to particular converting operations while wood chips and other residues from wood processing mills (sawmills and plywood mills) increasingly fed pulp and paper operations as sources of wood fibre and energy inputs respectively. In tandem, the labour force was expanded and organized by strong unions and collective bargains that emphasized seniority and job demarcation principles, and achieved 'cascading' rewards in the form of wage increases and non-wage benefits. In general, the industrial organization of BC's forest industries paralleled the major secondary industries of North America (autos, steel, chemical) except in regard to export orientation and the role of foreign investment.

3.2.2 The Winds of Change

After almost three decades of growth and expansion following WWII, "winds of change" became noticeable in the 1970s through fast and unexpected increases in energy prices, stagflation, and the termination of the Bretton Woods exchange-rate system. While the growth trend continued, volatility increased considerably. The forest industry started to face declining productivity and growth prospects, especially in terms of jobs and availability of first growth timber.

Until the 1970s, forests were essentially seen as a timber source. Other functions, such as biodiversity, habitat for wildlife, or non-timber uses were outside the focus of the Ministry of Forests (Marchak et al. 1999, 64). In the 1970s however, BC's forests started showing signs of exhaustion while reforestation had not kept up with harvesting. Improved technology had allowed companies to expand their capacities and to extend their operations exceeding the sustainable limit. The 1973 oil crisis, driven by a decline in consumer and industrial demand in the US and Europe, led to a significant downturn in BC's forest economy. Indeed, a sense of disquiet over winds of change, as well as longer standing concerns over corporate control of timber supplies, led the new ("left wing") provincial government to establish the Pearse Royal Commission to investigate the future of the forest economy (Pearse 1976). The commission recommended more competition for wood and a greater role for small firms; it suggested that harvest should be regulated with reference to long-term social and economic interests rather than just considering short-term timber values (Marchak et al. 1999, 65). Subsequently the Forest Act of 1979 resulted in the reorganization of the Ministry of Forests; the tenure system was modified, a new form of timber license and a new way to determine the AAC were introduced. Yet these changes were scarcely radical (Schwindt 1979); indeed, industrial practices hardly changed and harvest and production levels quickly bounced back. The latter part of the 1970s witnessed a return to booming conditions; timber harvest, production and employment levels reached peaks in 1979. The wood exploitation axis remained in control.

3.2.3 The 1980s Recession as a Turning Point

The recessionary crisis of the early 1980s was the biggest downturn in BC's forest economy since the 1930s and confirmed that the winds of change had arrived. With collapsing demand in major markets, the record corporate profits of 1979 became record losses in 1982, debt-equity ratios increased, layoffs were massive, plant closures were widespread, and corporations desperately sought cash by sales of assets, as demonstrated by the case of Canfor (see chapter 5). The recession was unusually prolonged, with markets and profitability not recovering until 1986. Unionized jobs, however, had permanently declined, and it was no longer business as usual.

From the perspective of industrial organization, the giant integrated forest corporations had become addicted to producing large volumes of a wide range of commodities with specialized machinery that processed a narrow range of low value products (Schwindt 1979). In the Interior, for example, the proliferation of new mills in the 1950s and 60s were widely referred to as ‘spaghetti mills’ dedicated to cutting to ‘2 by 4’s’ (admittedly in varying lengths!) for the housing market. Innovation was scarcely a concern, and the Coastal industry in particular had been slow to modernize. Meanwhile plantation economies in the southern hemisphere offered lower cost competition for standard commodities while the more innovative, quality conscious forest industries of Scandinavia provided an alternative model for high cost regions.

The 1980s recession in BC’s forest economy was part of a broader turning point or structural crisis of adjustment, often expressed as deindustrialization, which was sweeping through the traditional industrial regions of North America and Europe. In terms of the TEP model, vested Fordist routines, structures, and relationships were threatened by imperatives for more flexible practices as a result of technical changes driven by the ICT, increased global competition, and volatility, and greater consumer demand for more differentiated products. For BC’s forest economy, the ICT’s technological changes offered both labour saving productivity improvements and possibilities to differentiate and add value to products. However, for corporations rooted in a mass production culture, restructuring choices were neither easy nor obvious. The recession demanded deep cost cutting while modernization required substantial capital investment and product differentiation implied access to new markets and new technological choices. Moreover, markets and technological choices had become more sophisticated. However phrased, the varying strategies of rationalization, consolidation, diversification and modernization involved selectivity, judgment and faced considerable uncertainty.

The 1980s recession was a turning point for BC’s forest economy for several ‘sets of reasons’. First, the recession exposed the mass-production, cheap commodity structure of BC's forest economy as obsolete and inefficient in terms of maintaining present levels of activity. However, technological change and flexibility imperatives meant downsizing and rationalization. Second, fibre costs were increasing, and the provincial government made a first reference to the 'falldown effect' in 1981, that is when harvesting volumes based on cutting the most accessible and largest old growth forests start to decline and the industry has to rely increasingly on second growth forests with smaller volumes. This implied timber supply potentials had 'plateaud' and would likely at some point start to decline; falldown reinforced the need to rationalize.

Indeed, employment in BC's forest industries reached a peak in 1979 with more than 95,000 direct employees. Labour costs were high and, especially on the Coast, labour relations were deeply antagonistic. Logging methods and wood processing were inefficient and wasteful of timber – the biggest sawmills typically converted only 40% of the timber they received into lumber. Mass layoffs in the 1980s started the decline of the industry. Technological change made many jobs obsolete. For instance, timber harvest and lumber production were almost identical in 1979 and 1983, yet the employment in logging and lumber production declined from 55,000 to 35,000 (Allen 1986, 36).

Third, recession, industry downsizing, and falldown concerns stimulated significant and diverse forms of social conflict, often referred to as 'wars in the woods' (Hayter 2003) that were not anticipated by the industry nor properly understood regarding their long lasting economic implications. Yet these conflicts, involving the environment, Aboriginal rights, and trade, meant that the values associated with BC's forests had started to change from a purely industrial perspective towards multiple values, including biodiversity and spiritual values. The trade war also imposed restrictions on access to US lumber markets.

Thus, the wars in the woods reinforce the idea of the 1980s recession as a turning point. It radically redefined market, supply and demand conditions for BCs forest industry. Moreover, the restructuring imperatives were compounded by falldown and plateau effects. These changes are reflected by policies that evolved after the recession in the late 1980s but especially in the 1990s and 2000s. The ongoing search for appropriate policies intimates that the last several decades are part of a structural crisis of adjustment between the prevailing Fordist industrial paradigm and a changing business environment.

3.3 Timber Harvest and Use on the Plateau

BC has almost 60 million hectares of forested land. More than 93% (55.2 million ha) is owned by the provincial government, 3% is under federal ownership and only 1% is private property. Therefore, forest policy and government regulation play crucial roles in BC's forest economy. The two major regulatory variables set by the BCMoF are the annual allowable cut (AAC) which determines the quantity of timber available for harvest, and the stumpage rate, a de-facto tax for the harvesting of timber from Crown land

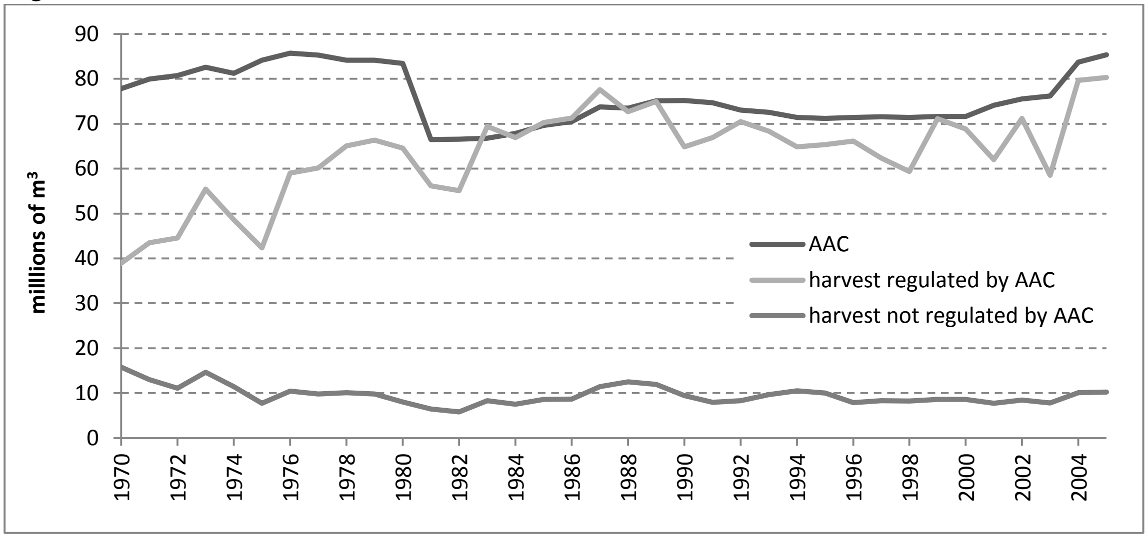
3.3.1 The AAC and Stumpage

The AAC in each region represents "*a sustainable harvest level that balances environmental, economic and social considerations*" (BCMoF 2007b, 138). Changes in the AAC reflect an increasing scientific knowledge about BC's forest ecosystems as well as a changed environmental consciousness of the public. The most conspicuous change to the AAC since 1970 was the sharp 20% drop from 1980 to 1981 as forest policy started to respond to the falldown effect (Marchak et al. 1999; Percy 1986) (figure 3.2). The AAC decreased slightly in the 1990s due to changes in forest practice and the establishment of new parks. The increase from 2000 on was stimulated by the booming US housing market and the need to recover pine beetle infested wood before it lost its entire economic value.

Harvest levels increased until the mid 1980s and then reached a plateau. Between 1983 and 1989, harvest levels were close to, or even exceeded, the AAC, and the question emerges as to whether industry faced a shortage of timber supply. However, this situation was unlikely the case. At the time, the provincial government practiced 'sympathetic administration' and was anxious not to obstruct the recovery from the early 1980s crisis by limiting firms' access to fibre. Thus, the AAC was increased in the early 1980s, and harvest levels were allowed to exceed the AAC in 1983 and 1987. Since 1990, there is no aggregate evidence of fibre supply shortages as the timber harvest has always been lower than the AAC.

While AAC and harvest levels plateaud, average fibre quality decreased over time, as accessible first growth became exhausted because of and the recent MPB infestation (see BCMoF 2007c; 2009a). About 11% of the harvest is not regulated by AAC, such as timber harvested from private land; that share did not change much over time.

Figure 3.2 BC, AAC and timber harvest 1970-2005

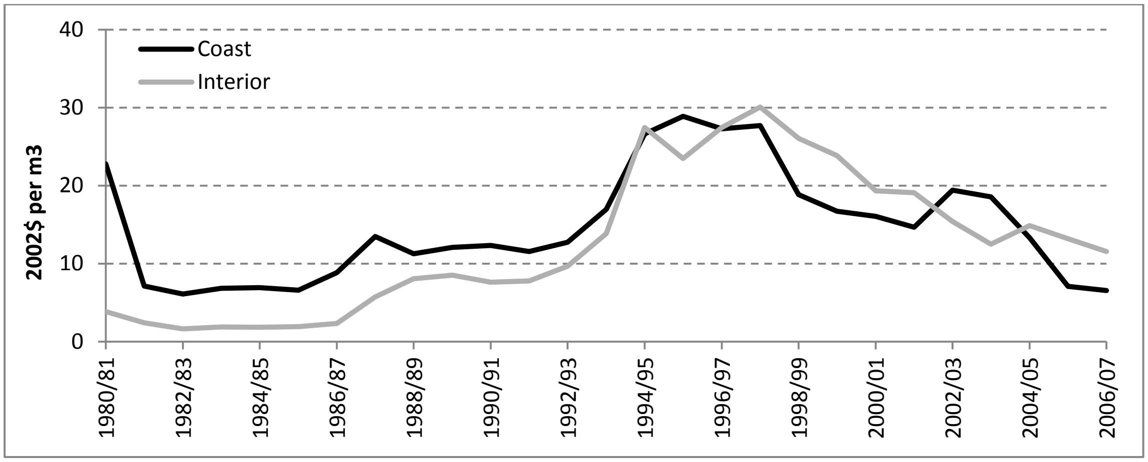


Data: BCMoF (2007b)

With respect to stumpage both on the Coast and in the Interior, overall trends reveal a collapse in payments during the 1980s recession, a partial recovery in the late 1980s, and a major spike in the 1990s followed by another collapse since 2001 (figure 3.3). The reasons underlying these fluctuations relate to market trends, policy changes, the US-Canada softwood lumber dispute and changing stumpage formulas. Historically, stumpage was calculated as a percentage of profits, roughly defined as revenues less costs, the latter including an uncertainty factor, and with industry itself providing much of the data. Low stumpage was considered important to attract investment, and industry long argued that revenues are based on fluctuating commodity prices and costs that are influenced by species mix, remoteness, rugged terrain, high wages and infrastructure provision. However, critics have long argued that low stumpage fails to incorporate the full values of forests, and in the 1980s American lumber interests, organized by the Coalition of Fair Canadian Lumber Imports (CFCLI), argued that BC's stumpage constituted a subsidy. In effect, the spikes in stumpage, especially the so-called super-stumpage regime' of the 1990s, were created by revisions in the stumpage formula to respond to these criticisms. These increases have not proven sustainable.

Figure 3.3 BC Coast and Interior, stumpage prices 1980-2007

(Average over all species)



Data: BCMoF, annual reports

Given a forest area of just over 59 million hectares, the timber harvest land base managed by the BCMoF increased from 1980 to 2005 from 37.9 to 42.8% of the total (table 3.2). The second largest area, controlled by various ministries, consists of riparian reserves, ungulate winter ranges, and inaccessible and uneconomic timber (BCMoF 2007b, 63), that share decreased between 1980 and 2005. The size of protected areas more than doubled, accounting for almost ten percent of total forested area in 2005. The rest is owned either by First Nations or privately.

Table 3.2 Management of BC's forest area 1980 and 2005

	millions of ha		%	
	1980	2005	1980	2005
Total	59.1	59.1	100.0	100.0
Protected areas	2.4	5.7	4.0	9.7
Managed by various ministries (no harvest)	31.1	24.6	52.7	41.6
First Nations	0.2	0.3	0.3	0.5
Private landowners	3.0	3.1	5.1	5.2
Timber harvest land base	22.3	25.3	37.8	42.9

Source: BCMoF (2011)

The allocation of harvesting rights changed significantly from 1980 to 2005 (table 3.3). In 1980, more than 70% of harvest rights were granted on a long-term base, mainly to large corporations, either through TFLs or through 15-20 years harvesting licenses. Until 2005, the share of long-run tenures decreased and TFLs and Forest Licenses only accounted for 57%. Increasingly, timber is allocated to small companies without own tenure. For that purpose, programs such as BC Timber Sales were established. To an increasing extent, timber is re-allocated from the owners of large tenures towards small firms. Consequently, the amount of timber available to small firms increased steadily since 1980 and accounted for more than one third of AAC in 2005.

Table 3.3 Timber harvesting licences in BC 1980 and 2005

1980				**2005**		
	000 ha	**%**			**000 ha**	**%**
Total timber harvest land base	22,333	100.0		Total timber harvest land base	25,300	100.0
Farm woodlots	4	0.0		Woodlot licenses and community forests	688	2.7
TFLs	4,567	20.4		TFLs	3,895	15.4
Timber Licenses outside TFLs	400	1.8		Forest licenses (up to 20 years)	10,494	41.5
Timber sale harvesting licenses (15-20 years)	11,356	50.8		BC Timber Sales	3,588	14.2
Timber sale harvesting licenses (short term)	6,006	26.9		Other licenses	2,955	11.7
				Reallocation from large licenses	3,706	14.6

Source: BCMoF (2011)

3.3.2 Timber Utilization

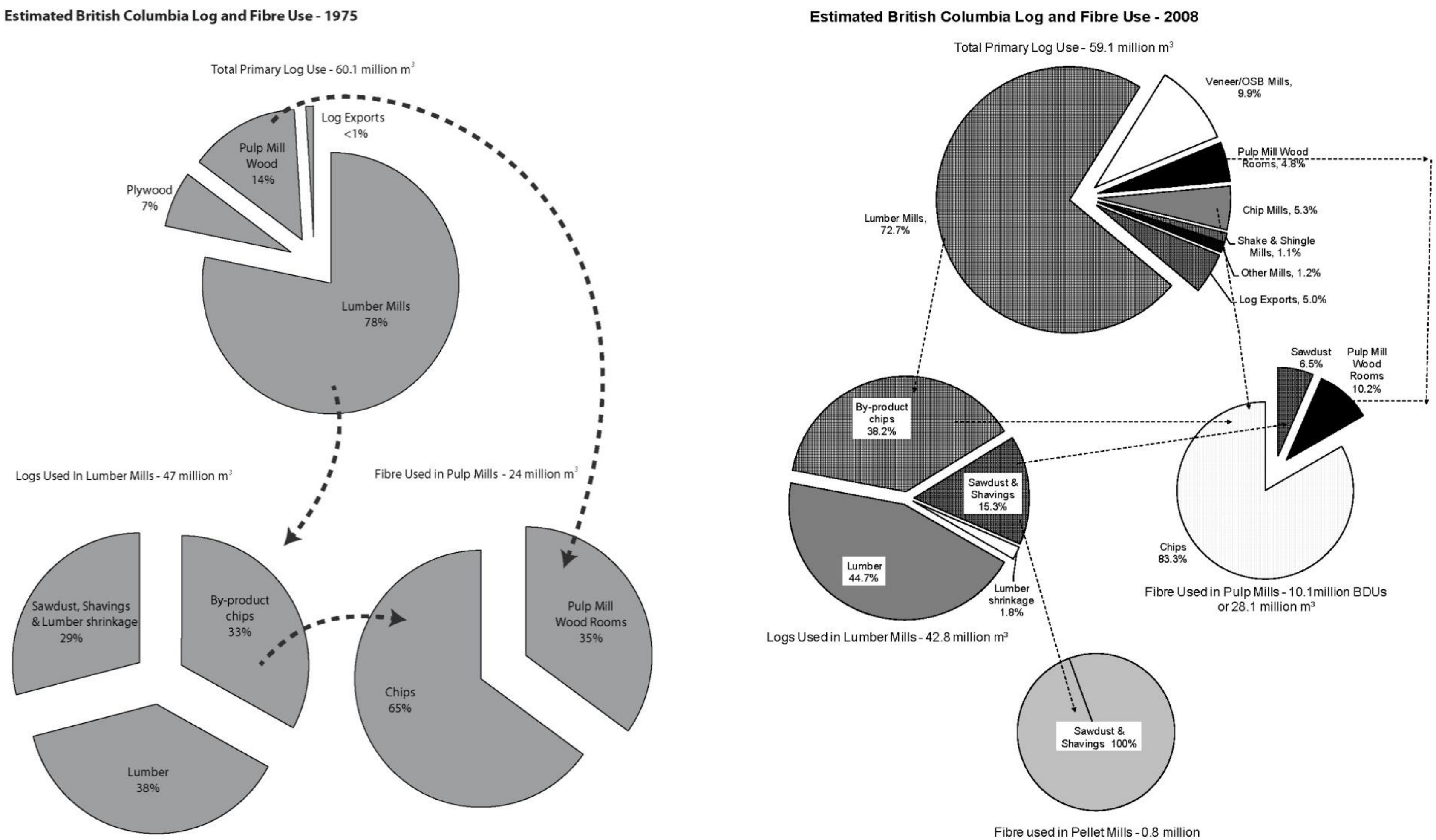
Total primary log use in 2008 was 58.1 million m^3 (BCMoF 2009b), almost the same as in 1975 when it was 60.1 million m^3 (BCMoF 1977). When comparing the log and fibre use between both years, several trends become evident (figure 3.4). First, lumber mills became more efficient. In the past decade, three important technological innovations occurred in BC's sawmilling industry (Maness 2006, 11f). The development of 3D laser scanning and optimization techniques and curve-sawing technology resulted in an increasing volume recovered from the log, while high-speed small log sawing machines increased the throughput of small diameter logs. Lumber recovery improved considerably, despite a decrease in fibre quality between 1975 and 2008 due to the falldown effect and the MPB epidemics. From 42.8 million m^3 logs used in 2008, 19.3 million m^3 lumber was produced, the equivalent of 8.1 billion board feet. In 1975, 47 million m^3 logs were converted into 17.7 million m^3 of lumber or 7.5 billion board feet.

Second, the product mix changed considerably from 1975 to 2008; new industries such as chip mills and pellet mills emerged. The share of veneer and OSB increased. Unfortunately, the broad categories used in the figure do not allow assessing further qualitative changes. Note that the statistics only refer to the primary log use and do not account for the secondary or value added wood and paper industries.

Third, in 2008 about 5% of logs were exported, compared to only 0.8% in 1975 when log export restrictions were tighter. From 1996, the SLA provided incentives for forest companies to export raw logs to the US for processing, thus reducing value generation in the province.

Finally, more of the industry's by-products are utilized for energy generation today. In 1975 most of the sawdust was burned.

Figure 3.4 BC forest industries, fibre use 1975 and 2008



Data and representation for 2008: BCMoF (2009b); data for 1975: Pearse (1976), own calculations

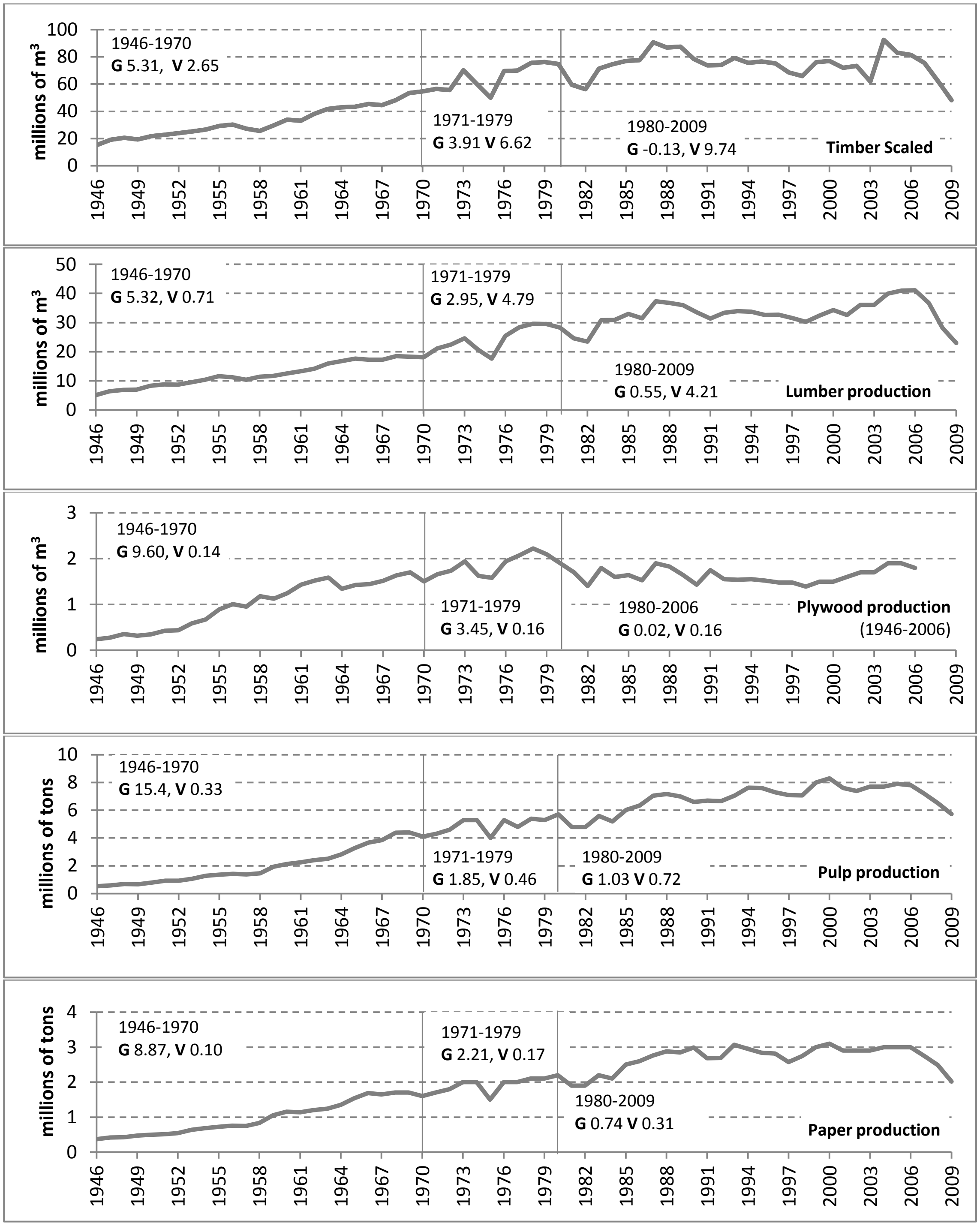
3.4 Indicators of Industrial Performance

3.4.1 Production and Shipments

The trends in timber harvest reflected in production time series (figure 3.5). During the long Fordist boom after WWII until about 1970, output was steadily growing, with few fluctuations. Harvest and lumber output fluctuated primarily around the US housing market while the pulp and paper business cycle, with its different industry-consumer base, had a somewhat different rhythm. The period from 1971 to 1979 was characterized by increased volatility through the oil crisis from 1973. All industries except plywood keep following a growing trend, albeit at a lower rate. Volatility remained high after 1980, with output levels stagnating or decreasing. After 2006, production dropped dramatically, to the level of 1980 or even below. An exception is plywood production. As the industry is younger and more dynamic, both growth rates and variation are higher. Shipments, or industrial sales, follow a pattern similar to production (figure 3.6). Growth rates are stable and consistent until about 1970. Volatility increases throughout the 1970s and the recession of the early 1980s clearly stands out as turning point. The cyclical pattern of the shipments is more pronounced compared to production, because firms tend to stockpile inventories during recessions, sustaining production to some extent in order to keep capital employed.

Note the fact that recessions effect lumber and pulp and paper shipments differently. The recessions in 1973, 1980-82, and 2007-09 had more impact on lumber markets, while pulp and paper were more affected during the 1990 and 1997 crises. For a long time, this fact seemed to justify the diversification of forest firms into both lumber and pulp production lines.

Figure 3.5 BC, production of major forest products 1946-2009

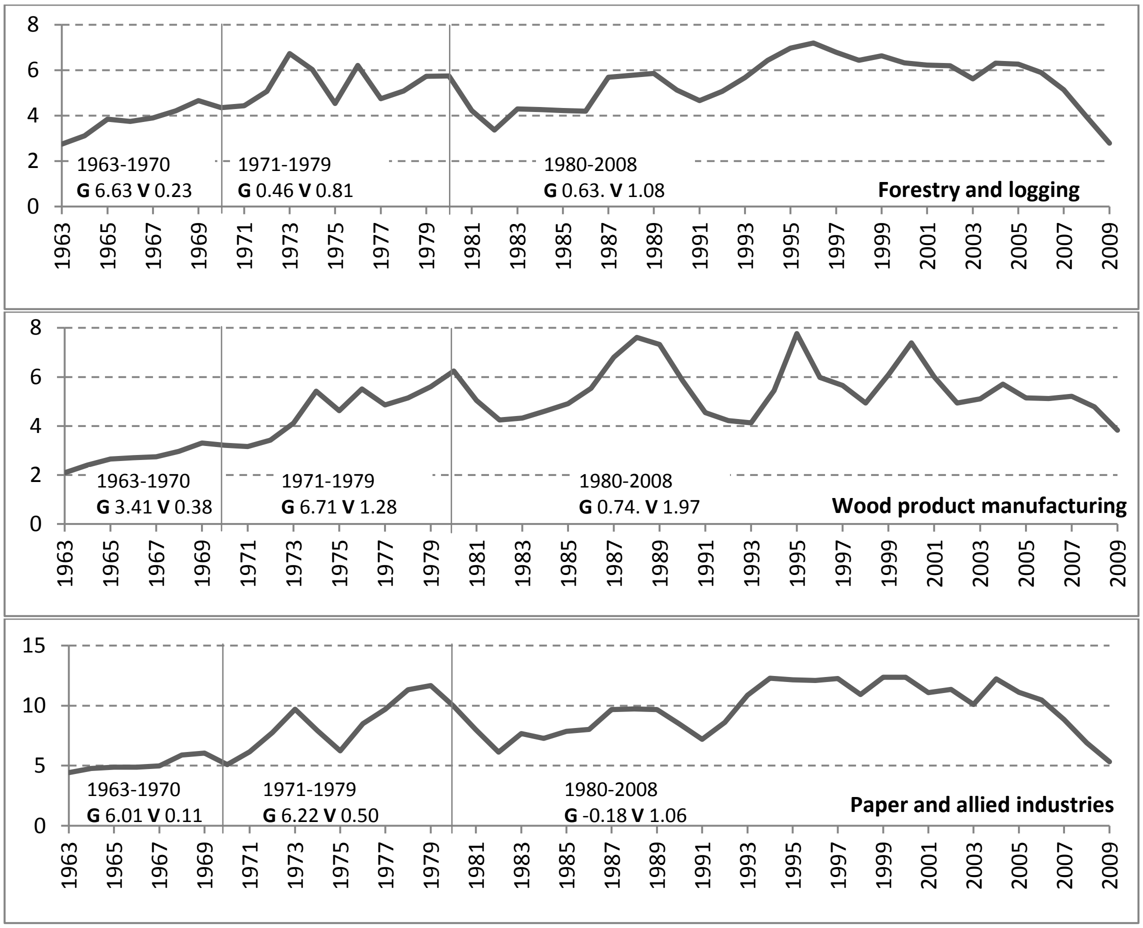


G: Average annual growth rate, based on trend line. V: Standard deviation without trend effect

Data: BC Economic and Statistical Review, BC Financial and Economic Review

Figure 3.6 BC forest industries, shipments 1961-2008

(Unit for all graphs: millions of 2002$)



G: Average annual growth rate based on trend line. V: Standard deviation without trend effect

Data: Statistics Canada, Principal Statistics (CANSIM tables 3010001, 3010002, 3010003, 3010004, 3010006, 3010007); CPI: CANSIM table 3260020

At a finer industrial scale, the increasing importance of the value added industries is noteworthy (table 3.4). Most SME's in BC's forest sectors operate on a small scale, with less than 50 employees and annual revenue of less than $3 million[5]. Many are undercapitalized and operated and managed by the owner. Contrary to primary mills that rely on a high volume and low unit costs, the value added industries are high cost producers with small output volumes. There are few direct connections, such as common ownership, between primary manufacturing and the value added sector, a "*culture of two solitudes*" (Woodbridge Associates 2009, 77).

[5] Generating more value from our forests. Report of the BCMoF; http://www.for.gov.bc.ca/het/valueadded/valadded_report.pdf (retrieved Feb 14, 2011)

Together, the value added wood and paper industries accounted for about 21% of sales in 2005. During the 2007-09 recession, they even reached a share of almost 30% due to the drop of lumber and pulp sales. Despite that increase, commodities such as lumber, pulp and newsprint still make up the bulk of production, accounting for 76% of output in 2005.

Table 3.4 BC forest industries, sales by sub-industry 1970-2009

(Sales in millions of 2002$, industry percentage in brackets)

	Wood product manufacturing			**Paper and allied industries**	
	Sawmills, planing and shingle mills	Veneer and plywood mills	Other wood industries	Pulp and paper mills	Other paper industries
1970	3,899.2 (74.6)	897.3 (17.2)	432.6 (8.3)	3,528.9 (90.2)	381.8 (9.8)
1980	7,971.0 (78.3)	1,265.8 (12.4)	938.5 (9.2)	6,552.6 (92.0)	569.7 (8.0)
1990	7,091.3 (80.1)	981.5 (11.1)	782.7 (8.8)	6,048.7 (94.0)	388.0 (6.0)
2000	9,912.7 (77.0)	1,686.2 (13.1)	1,268.7 (9.9)	7,428.2 (94.5)	436.0 (5.5)
2005	7,704.5 (69.4)	1,947.0 (17.5)	1,444.3 (13.0)	4,722.3 (91.7)	428.5 (8.3)
2009	3,196.5 (60.1)	977.1 (18.4)	1,144.2 (21.5)	3,514.0 (91.7)	319.9 (8.3)

Source: Statistics Canada, Principal Statistics (CANSIM tables 3010002, 3010003, 3010006)
CPI: CANSIM table 3260020

Forest product exports are highly sensitive to booms and busts. Exports showed a growing trend until 1995 and started to decline from then. Between 1996 and 2004, the average annual value of BC's forest products exports was $14.7 billion; in 2009, that value dropped to $7.6 billion. The evolution of exports since the Fordist era is reflected by three large trends. First, the importance of forest products for BC's exports has dramatically declined due to the increasing diversification of BC's economy. Until the mid-1990s, forest products accounted for 50-60% of total exports. That share decreased rapidly from 1995 on and was lower than 30% in 2009[6].

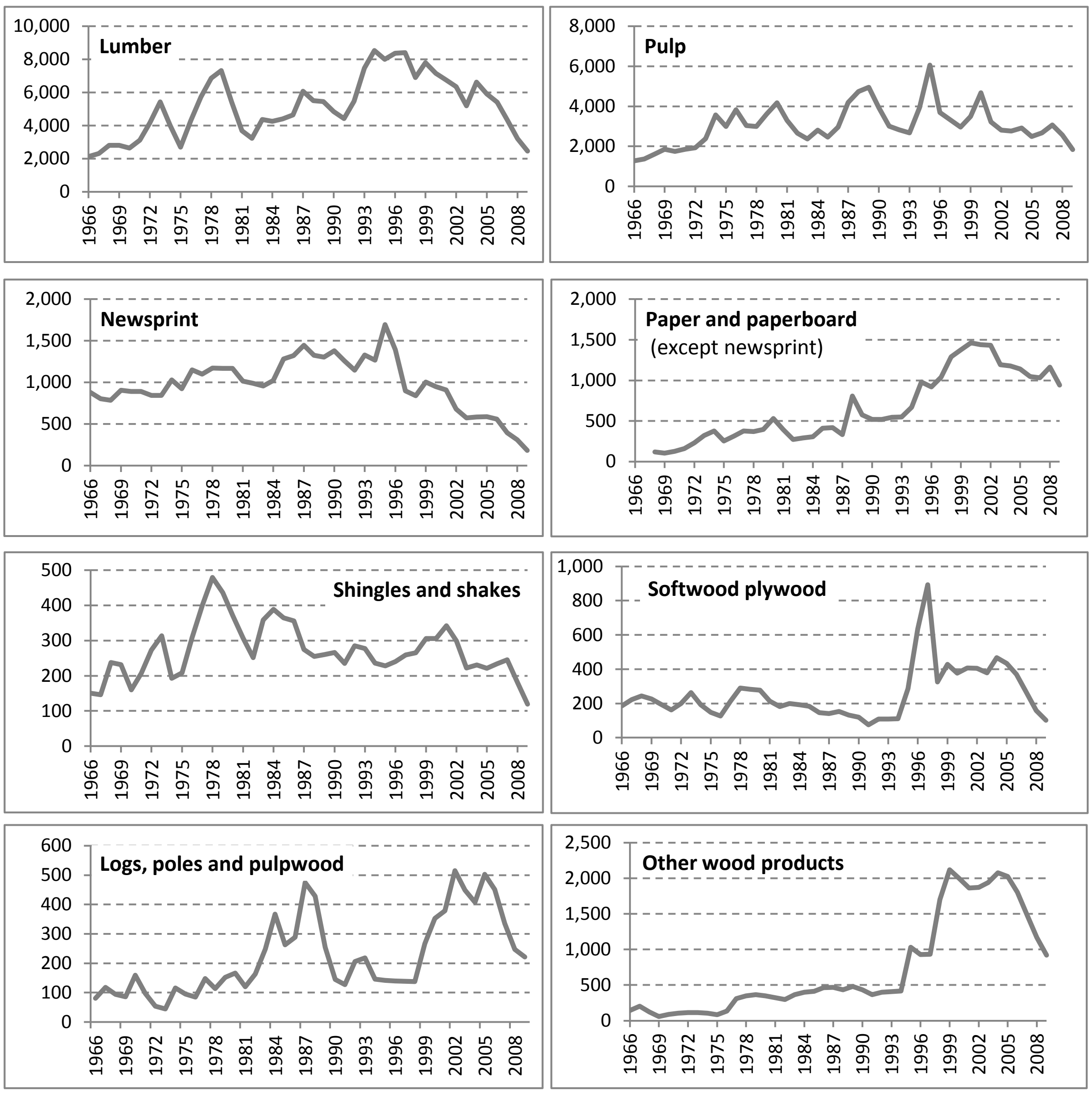
Second, both type and value of BC's forests exports are changing. Commodities, such as lumber, pulp, and newsprint make up for the bulk of exports (figure 3.7). The accumulated share for these three product groups accounted for 90% of all forestry export in 1967 and as much as 95% in 1987. From the mid 1990s on, that share started to decrease gradually, but it was still as high as 2/3 in 2009. Value added product, such as paper and paperboard (except newsprint) and "other wood products" increased their

[6] BC Financial and Economic Review, various years;
http://www.fin.gov.bc.ca/archive/f&ereview.htm (retrieved August 2, 2011)

share. The striking spike in plywood exports in 1996 and 1997 is associated with the Japanese housing boom[7]. However, the Asian Crisis ended that boom in the same year.

Figure 3.7 BC, exports of selected forest products 1966-2009

(Unit for all graphs: millions of 2002$)



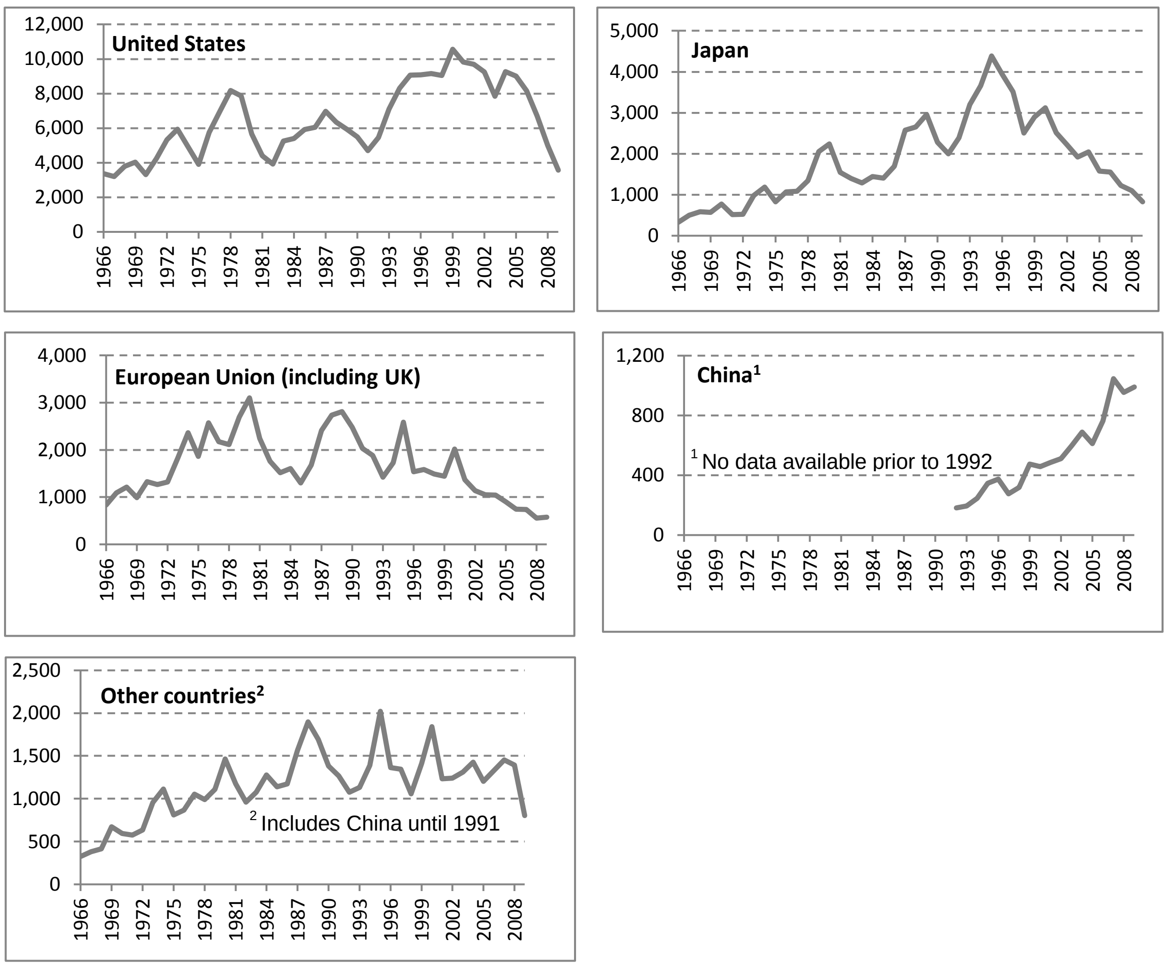
Data: BC Economic and Statistical Review, BC Financial and Economic Review;
CPI: CANSIM table 3260020

[7] BC Stats Feature: Canadian Building Product Exports Climb as Japanese Regulatory Barriers Fall, August 1997;
http://www.bcstats.gov.bc.ca/pubs/exp/exp9705.pdf (retrieved August 2, 2011)

Third, the US continues to be the dominating destination for BC's forest exports (figure 3.8). While the share of exports to the US dropped below 50% in the beginning and the end 1980s, it increased again from 1988 to 2004 and remained higher than 50% even during the recent crisis. Despite increasing protectionism and the recent financial crisis, the US market remains the major export destination for BC's forest industry, due to its geographic proximity and enormous dimension.

Figure 3.8 BC, exports of forest products by destination 1966-2009

(Unit for all graphs: millions of 2002$)



Data: BC Economic and Statistical Review; BC Financial and Economic Review; Industry Canada: Strategis database; CPI: CANSIM table 3260020

Apart from the US, BC's export markets shifted considerably. The share of the European Union (including the UK) declined from over 30% in 1952 to less than 10% after 2000. For a long time, Japan was BC's second important export market, accounting for almost a quarter of the forest exports in the early 1990s. Eventually those exports broke down due to the 1997 Asian Crisis. In addition, changed building regulations after the 1995 Kobe earthquake reduced the use of lumber in construction. The crisis also depreciated the currencies of several Southeast-Asian countries, causing Japan to shift away from Canada as a source for lumber imports and it never regained its old importance for BC (see Edgington 2004; Reiffenstein 2006). However, there is a chance that the rebuilding of Japanese towns that were destroyed in the 2011 earthquake and tsunami could stimulate the re-emergence of the lumber trade connections with BC.

From the 1990s, China emerged as new export market. In 2008, it replaced Japan as second largest export market. BC's lumber industry puts great hope into the Chinese market, which is demonstrated by several trade delegations. So far, exports to China mainly include low grades, but increasingly higher grades are purchased. This is mainly due to three reasons: the continued growth of the Chinese economy, especially the residential and non-residential construction sector, led to the increasing use of Western Canadian SPF. In addition, China is shifting away from Russia, its traditional timber supplier, because of economic, environmental, and supply concerns. Finally, successful efforts by the BC government to promote wood-frame construction and BC wood products increased the acceptance of SPF products (Canfor Corporation 2010, 10).

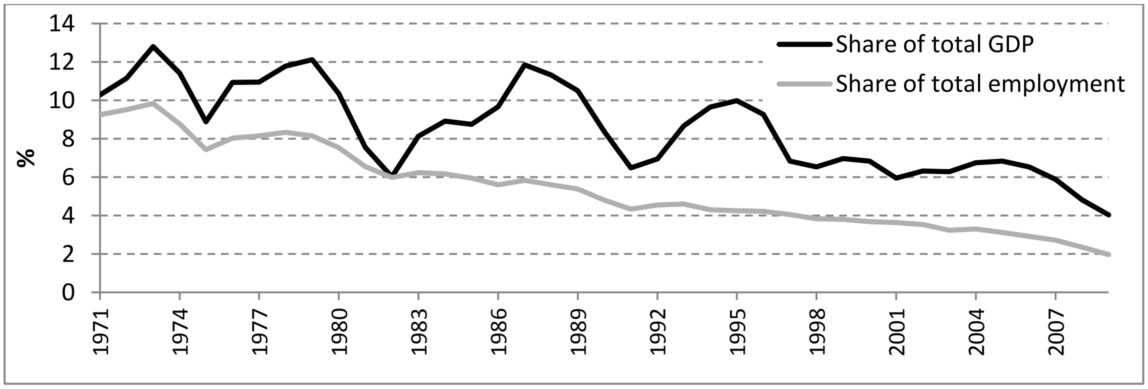
3.4.2 Employment Perspectives

In 2007, direct and indirect jobs in the forest sector accounted for about 7% of employment in the province (BCMoF 2011, 6). Since 1980, total employment in the forest sector has slowly declined, while the province′s economy has grown and diversified. The downsizing of the forest industry after the 1980 crisis resulted in less employment generated (figure 3.9) and less taxes paid by the forest industry and in manufacturing in general. In 2010, 80% of BC's workforce was employed in the service sector[8]. This development likely led to declining political influence and a decreased political interest in the forest industry. In addition, the role of the Lower Mainland (almost half of BC's population) for the forest industry changed and its ties with the vast hinterland weakened. Nevertheless, many communities, especially in rural areas, are still

[8] BC Statistics; http://www.bcstats.gov.bc.ca/data/dd/handout/naicsann.pdf (retrieved November 9, 2011)

highly dependent on forestry jobs. In 2005, about 8% of provincial total labour income came from the forest sector (BCMoF 2011, 6). In addition to the 54,000 direct jobs in 2008, the forest industries generated at least as many indirect jobs; their number is estimated between 58,000 (according to the Survey of Employment, Payrolls and Hours) and 65,000 (according to the Labour Force Survey)[9].

Figure 3.9 BC forest industries, share of GDP and employment 1971-2009



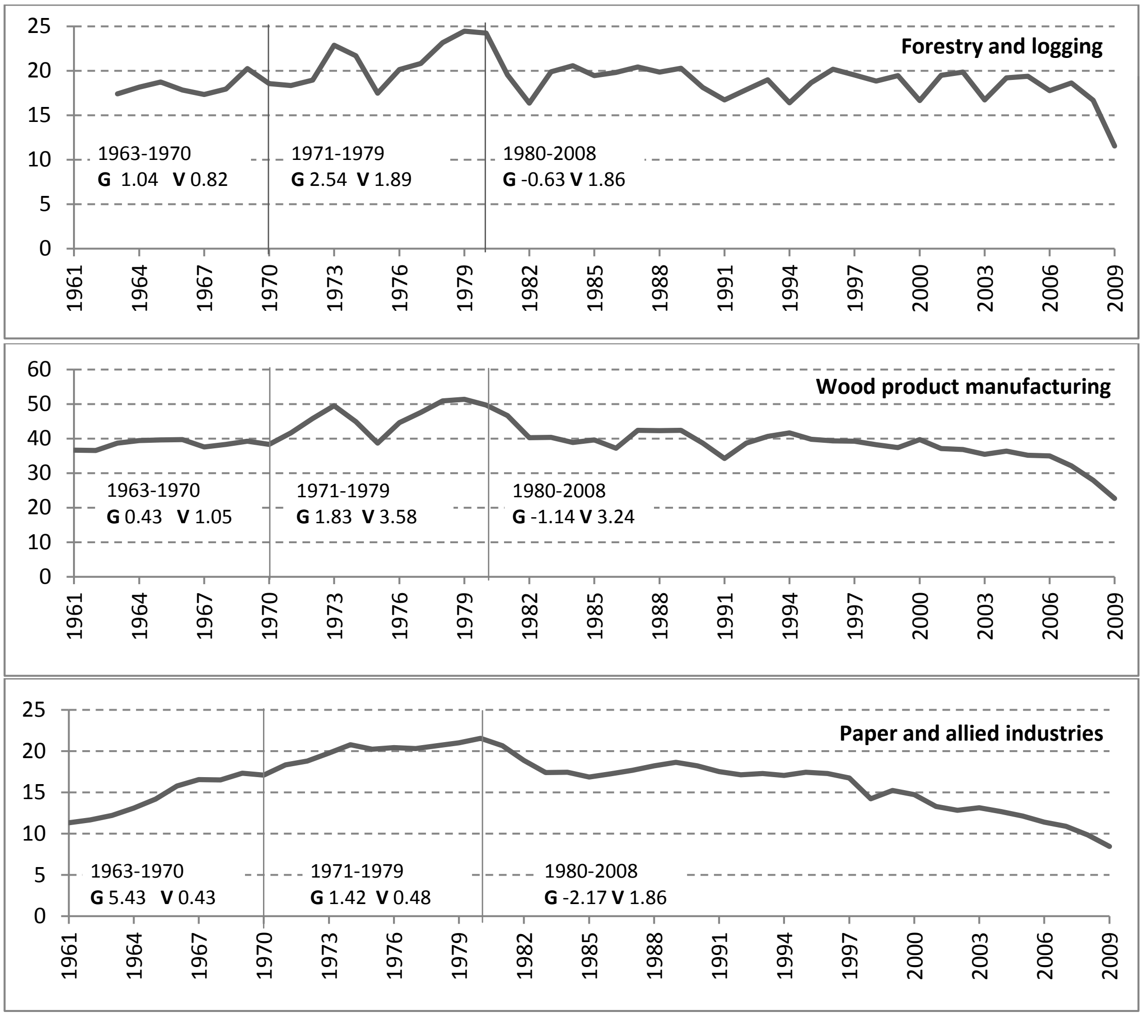
Data: Statistics Canada: GDP by industry: (CANSIM Matrix 7880, CANSIM Tables 3790003 and 3790025); CPI: CANSIM table 3260020

Similar to harvest and output, the employment time series can be structured into three periods (figure 3.10). The Fordist area until about 1970 with steady growth and low volatility, the period from 1971 to 1982 with high volatility and continued growth, cumulating in the 1980s crisis. From then on employment starts to decline while volatility remained high.

[9] Natural Resources Canada, statistical data; http://canadaforests.nrcan.gc.ca/statsprofile (retrieved March 8, 2011)

Figure 3.10 BC forest industries, employment 1961-2009

(Unit for all graphs: thousands of employees)



G: Average annual growth rate, based on trend line; V: Standard deviation without trend effect

Data: Statistics Canada, Principal Statistics (CANSIM tables 3010001, 3010002, 3010003, 3010004, 3010006, 3010007)

A finer industrial scale reveals the increasing importance of the value added industries (table 3.5). Both value added industries increased their share and accounted for 35% of employees in 2005 and more than 40% in 2009 as the value added industries were less affected by the recent recession.

Table 3.5 BC forest industries, employment by sub-industry 1970-2009

(Number of employees, industry percentage in brackets)

	Wood product manufacturing			**Paper and allied industries**	
	Sawmills, planing and shingle mills	Veneer and plywood mills	Other wood industries	Pulp and paper mills	Other paper industries
1970	28,212 (73.6)	6,986 (18.2)	3,131 (8.2)	14,831 (86.8)	2,258 (13.2)
1980	37,564 (75.6)	6,928 (13.9)	5,216 (10.5)	19,066 (88.5)	2,474 (11.5)
1990	28,743 (74.3)	5,413 (14.0)	4,534 (11.7)	16,541 (90.9)	1,661 (9.1)
2000	27,796 (69.9)	6,011 (15.1)	5,934 (14.9)	13,020 (88.3)	1,727 (11.7)
2005	21,924 (62.4)	6,298 (17.9)	6,896 (19.6)	10,406(85.8)	1,717 (14.2)
2009	12,043 (53.3)	4,534 (20.0)	6,052 (26.7)	7,126 (84.3	1,331 (15.7)

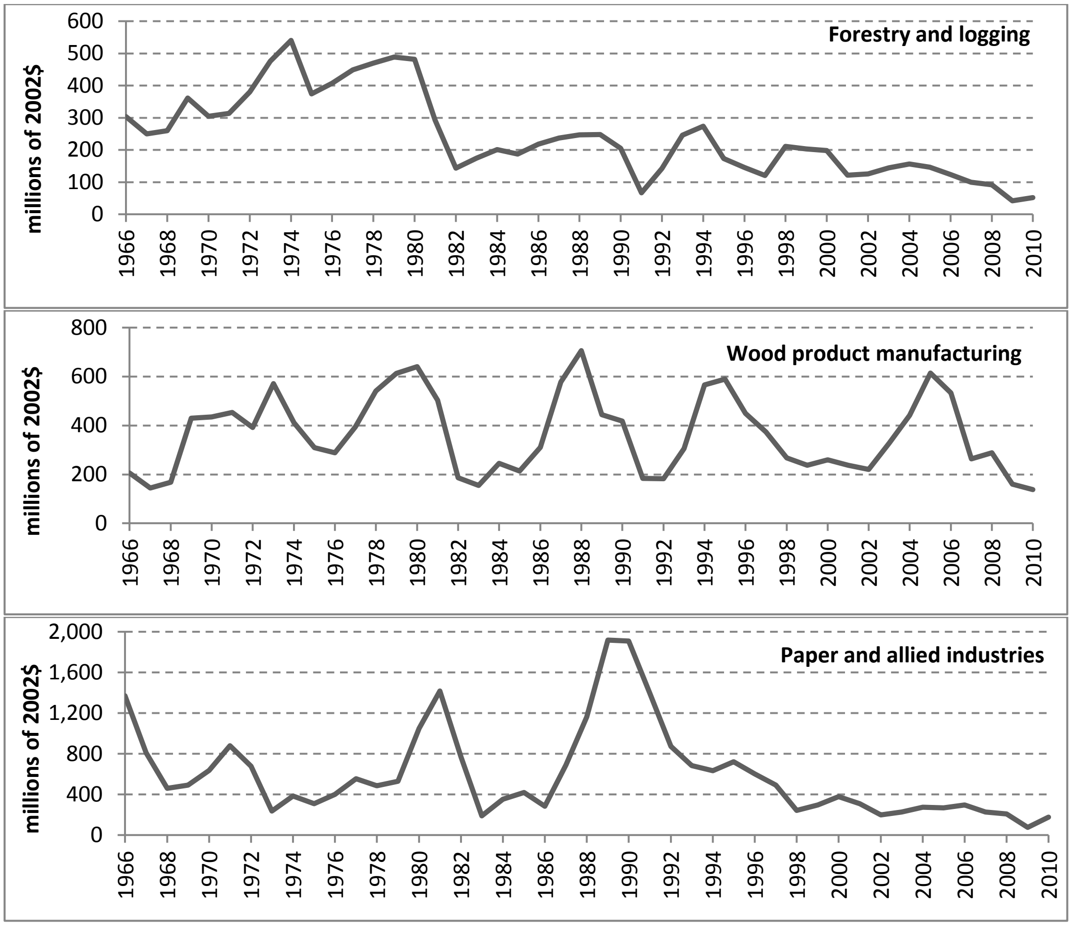
Source: Statistics Canada, Principal Statistics (CANSIM tables 3010002, 3010003, 3010006)

3.4.3 Investment and Profitability

Investments in the forest industries, measured by capital expenditure, have a substantial cyclical movement, characterized by periods of booms and bust (figure 3.11). Capital expenditure in forestry and logging decreased sharply after 1980 and followed a declining trend since then. Until 1980, most of the province had already been logged and most of the remaining old growth forest was under protection. Thus, the need to invest in new infrastructure in order to make new areas accessible for logging, declined. Most railroads, logging roads, and bridges were already in place and could be re-used.

Investment in the wood industries follows a cyclical pattern. Renewal of buildings and equipment usually take place during boom periods, through the reinvestment of profits. The recent spike (2002-2005) is related to the construction of new sawmills, some of them with huge capacity ("super-sawmills") in the Interior in response to large quantities of MPB wood available for processing. It is estimated that from 2002-05 over $1 billion was invested in new manufacturing capacity and advanced technologies (Woodbridge Associates 2009, 58).

Figure 3.11 BC forest industries, capital expenditure 1966-2010

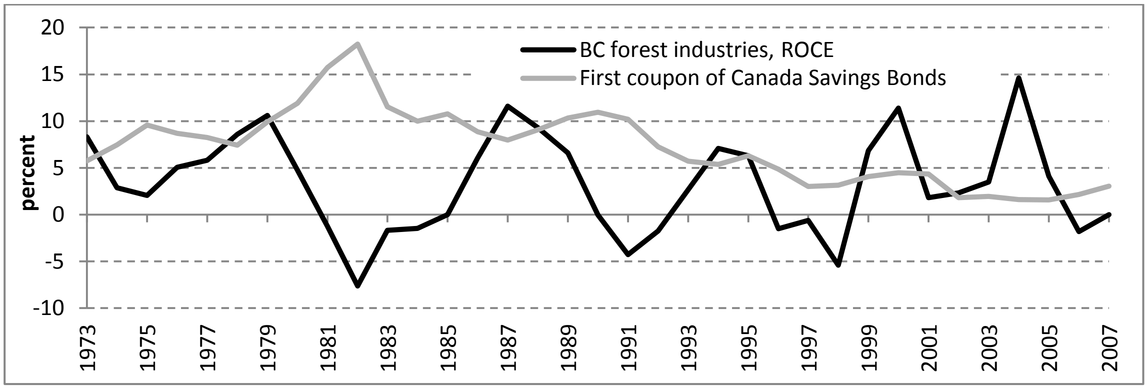


Data: Statistics Canada (CANSIM tables 290005 and 290034); CPI: CANSIM table 3260020

Capital expenditure in paper and allied industries can be traced to the building of new pulp mills, which require substantial financial capital. In such ways, the investment peaks refer to the construction of mills in Prince George (1965-68), Kitimat (1970), Quesnel (1981), and Taylor and Port Mellon (from 1988). BC's forest industry has been notoriously unprofitable for decades, particularly on the Coast, where the costs for labour and fibre are substantially higher than in the Interior. The "BC discount factor" resulting from the wars in the woods refers to major planning uncertainty, low shareholders' return, and added expense and risk of doing business in BC due to major uncertainty over future land use and property rights.

A popular measure for the profitability on an industry is the return on capital employed (ROCE), defined as the earnings before interest and taxes (EBIT) divided by the total assets employed excluding current liabilities. The ROCE measures the efficiency with which capital is utilized to generate revenues. The average annual ROCE for BCs forest industries from 1973 to 2007 was 3.3%, compared with an average return of 7.2% for Canada saving bonds over the same periods (figure 3.12); these bonds are liquid securities, guaranteed by the government and are therefore quasi risk-free.

Figure 3.12 BC forest industries, return on capital employed (ROCE) 1973-2007



Data: ROCE: PWC (1987; 1994; 2007), BCMoF, annual reports, various years
Bond returns: Statistics Canada, CANSIM series v122510

Those findings are in line with the study conducted by Schwindt and Heaps (1996, 80-1) who found an average return of 3.06% for BC's forest industry over the period from 1977 to 1985. A generally accepted return for the industry would have to be at least 10-13% in order to remain profitable and to attract investors, because the cost of capital is approximately that high (Schwindt and Heaps 1996). In most years, the industry has failed to achieve this target, only in 2000 (ROCE of 11.4%) and 2004 (14.6%) the goal was met, due to the booming US housing market. In the past, however, investors, could profit from mergers and acquisitions and take advantage of stock price fluctuations resulting from the typical boom and bust pattern, which made up for the low ROCE (Woodbridge Associates 2009, 9). The gradual withdrawal of foreign companies from BC is likely associated with the continuing low rates of return.

3.5 The Re-regulation of BC's Forest Economy

The 1980s recession marked a turning point in the regulation of BC's forest economy. The policy established in the 1947 forest act amendments, themselves changing the Forest Act passed 35 years previously, were only modified in detail, for example with respect to timber utilization levels, over the next 30 years. During the 1970s a growing appreciation of the need for reform led to the Pearse Royal Commission and the Forest Act of 1978. But the new initiatives left existing practices intact. However, following the 1980s recession there has been an array of regulatory changes that have profoundly changed the demand and supply conditions underlying the industry. Since the provincial government has control of Crown forests most of this legislation was passed by the provincial government (table 3.6). However, the federal government is responsible for trade, and it has signed three key softwood lumber agreements with the US that have imposed restrictions on lumber exports to the US (Table 3.7). The Federal government has key roles to play in the Treaty Process, and in the regulation of salmon bearing rivers.

This policy barrage was unleashed by the wars in the woods that became inflamed during the 1980s recession. Essentially, the wars in the woods consisted of three separate conflicts that targeted the forest industry and challenged the wood exploitation axis forged by the industry, government and labour. These conflicts were enflamed by the 1980s recession. Environmental nongovernment organizations (ENGOs) were empowered by the seeming demise of the forest industry, which they perceived as a sunset sector, a view supported by the Ministry of Forestry's first public recognition of falldown in 1980. Aboriginal peoples also became alarmed about loss of their resource base (Hayter 2003, 716). Furthermore, the recession spurred the US trade protectionism lobby mainly consisting of the Coalition for Fair Canadian Lumber Imports (CFCLI), which accused Canada to unfairly subsidize lumber exports.

The recognition of the role of ENGOs and First Nations resulted in a shift in forest policy from the 1990s onwards. In 1991, strongly affiliated with environmental groups, Aboriginal Peoples, and labour unions, political priorities changed towards the regulation of land use. That process was driven by two major ideas: the need for more protected areas and the management of BC's forests according to principles of sustainable use. These ideas were implemented in a number of important policy measures that have represented attempts to reregulate the industry. According to Hoberg (1996), high prices and good market conditions for BC wood products in the early 1990s created a situation that alleviated regulation. Essentially, it became politically feasible for the government to implement regulation and protected areas, and affordable for the industry to concede. The key forest policy initiatives since the late 1980s cannot be discussed in detail; they are summarized in table 3.6. From the table, two major conclusions can be drawn:

First, forest policy shifted from primarily serving the needs of the (big) industry towards the needs and requirements of other groups, reflecting the recognition of non-industrial uses of BC's forest resources. Thus, the policy initiatives incorporate environmental values, such as the abolishment of clear cutting and the extension of protected areas. Other initiatives are targeted towards small firms, especially the redistribution of AAC from large long-run tenures and the foundation of BCTS, or towards First Nations and local communities (community forests) (ABCFP 2009). The forest industry ceased to be the primary focus for forest policy measures.

Second, the sheer number of policy initiatives since the late 1980s stands in stark contrast to the stability of the Fordist period. New policy initiatives have been introduced every couple of years, thus the industry has to respond to frequently changing the rules and regulation that govern harvesting and timber processing practices, which interferes with long-run planning security. Volatile policies have imposed a great amount of uncertainty on the industry. To make things worse, some of those initiatives are contradicting, such as the super-stumpage in the 1990s that was replaced by a "market-based" system in the 2000s.

Table 3.6 Key forest policy initiatives in BC since 1987

Year	Policy	Comment
1987	Amendments to the *Forest Act*[1]	reforestation becomes an obligation of operators (at their own expense) on Crown land.
1988	Revised Stumpage formula[1]	Shift from market-based system to waterbed system. Costs of basic silviculture and major roads transferred to industry.
1988	Small Business Forest Enterprise Program (SBFEP)[1]	5% of wood taken from major licensees (such as TFLs) and redistributed to small firms
1992	Commission on Resources and the Environment (CORE)[2]	Multi-stakeholder, consensus-based land use decision-making process at the provincial scale (ENGOs, First Nations, forest industry, provincial government)
1992-	Stumpage level ratchets[2]	Ratcheting up of stumpage on yearly basis from 1992 ("super stumpage")
1992-	Pulp Mill Effluent Standards[2]	New targets for all pollutants. AOX levels to be reduced to zero by 2001.
1993	Land Resource Management Plans (LRMP) [2]	Multi-stakeholder, consensus-based land use decision-making process at the sub-regional scale
1993	Protected Areas Strategy (PAS) [2]	Double the area under protection (12% by 2000, 14.3% by 2011)
1993-	Treaty Process[2]	Canada-BC Memorandum of Understanding creates a five-stage treaty process to resolve Aboriginal land claims tha cover entire province.
1994	Forest Renewal Act[2]	Abolishingment of clear-cutting practices, reforestation requirements.
1995	Forest Practices Code[2]	Reform forestry to meet environmental values: continuous clear-cutting eliminated and the size of clear-cuts reduced. Reforestation made mandatory. Wildlife, biotic and aesthetic values incorporated in forest plans.
1995	Forest Land Reserve Act[2]	Regulation of forest practices and long-term management of forested land under private control, such as long-term tenures and tree farm licenses
1997	Community forests[2]	Proposals requested in 1997, with three to be awarded
1997	Jobs and Timber Accord[2]	Government creates aimed at increasing jobs and reducing costs in forest sector. Innovative Forestry Agreements added to Forest Act.
2002	Forest Practices Code[3]	Deregulatation of BC's forest economy through timber auctions and changes to environmental regulations
2003	Forest Revitalization Act[3]	Appurtenancy abolished. BC Timber Sales (BCTS) created to sell timber by auction; 20% clawback from tenure holders to supply auctions, community forests, and Aboriginal Peoples. Community forests (43 in 2010)
2004	Forest and Range Practices Act replaces Forest Practices Code[3]	Market Pricing stumpage on the Coast. (2006 also in the Interior).
2008	Legislation to facilitate the use of Crown timber for bio-energy introduced[3]	Plan to utilize pine beetle wood for generating energy.

[1] Social Credit; [2] NDP; [3] Liberals
Source: based on Hayter (2000, 90); ABCFP (2009, 1-4ff)

The US-Canadian trade conflict has severely increased uncertainty for the industry about its major market. An overview over the conflict is provided in table 3.7. While agreements were reached in 1986, 1996, and 2006, each of them was preceded by extensive disputes and litigation.

The key feature of this conflict is the fact that the powerful US lumber lobby seeks to protect its domestic lumber industry from Canadian imports. Although an agreement has been reached in 2006, imposing a price-dependent export charge that does not imply that the conflict is over; the return to a free-trade regime in foreseeable time seems extremely unlikely.

Likewise, the dispute with ENGOs and Aboriginal Peoples is not over yet. While spontaneous, unregulated and violent actions have been replaced by formalized negotiations, the conflict is lingering. Environmentalists reached many of their goals, including the establishment of the Forest Practices Board as an independent watchdog, but the Aboriginal land claims are far from being resolved. In the case of BC's First Nations, it took 27 years (from 1973 to 2000) only to reach an agreement in the Nisga'a treaty process. The fact that over 200 Aboriginal bands exist in BC, whose territorial claims are often conflicting and overlapping and with whom treaties have to be negotiated separately, implies that this issue will occupy BC's governments for decades to come.

Table 3.7 Overview over the Canadian-US Softwood Lumber Dispute

Policy	Comment
1986 Memorandum of Understanding (MOA) (1986-1991)	An investigation by the US Commerce Department leads to the conclusion that stumpage rates represent unfair subsidies. As a result, a 15% tariff is imposed on softwood lumber imports from Canada (later replaced by a Canadian 15% export charge on softwood lumber exports).
1996 SLA (1996-2001)	In April 1996, Canada and the US sign an agreement that allows the four provinces affected by the pact - British Columbia, Alberta, Ontario, and Quebec- to export 14.7 billion board feet of lumber to the US annually. Additional volumes are allowed, but will carry penalties of $50 and $100 per thousand board feet. A “bonus” feature allows extra exports if an agreed-upon trigger price is met or exceeded.
2006 SLA (since 2006)	The US agree to remove the countervailing and anti-dumping duties on Canadian softwood lumber and to return more than $4.5 billion in duties that were collected since 2002. Furthermore, the US agree not to initiate any new investigations against Canadian softwood lumber while the agreement in effect Canada agrees to cap softwood exports to the US at 34% of the US market. An export charge on Canadian softwood lumber exports is imposed when the price of lumber is at or below US$355 per thousand board feet. Canada and the United States further agree to terminate all litigation before entering the agreement (such as pursuing cases through NAFTA and the WTO). The length of the agreement is seven years, beginning in 2006, with an option to extend it for an additional two years. However, either country could unilaterally exit after three years. As an amendment, if the agreement is not renewed, or if the US unilaterally decides to terminate the agreement, then no duties can be imposed until one year after the end of the deal. The US also has to provide Canada with six months’ notice before ending the agreement.

Source: based on http://www.randomlengths.com/pdf/Timeline.pdf (retrieved Jan. 10, 2011) and Makarenko (2008), http://www.mapleleafweb.com/features/the-canada-us-softwood-lumber-dispute#history (retrieved Jan 10, 2011)

During Fordism, the wood exploitation axis guaranteed a forest policy in favour of BCs forest industry. Since the 1980s, this has changed radically. Today all policy decisions that are crucial for the forest industry are made with the participation of ENGOs and First Nations. From the industry’s point of view access to timber has become more complicated, not so much because supply has actually decreased, but because changed environmental and reforestation regulations increased harvesting costs. The sheer number of actors involved in policy decisions (industry, Provincial Government, ENGOs, First Nations) resulted in increased difficulty to reach a favourable outcome and in increased uncertainty in general. In addition, the trade conflict with the

US has made the access to the most important market more difficult and uncertain. The economic volatility in the industry has been complemented by policy volatility and the uncertainty over frequently changing policy initiatives that in some ways are experimental and vary by the political party.

3.6 Conclusion

Since 1980 or from the 1970s if the energy crises are used as the starting point, the BC forest economy has experienced remarkable volatility. Each of the booms and busts can be readily equated to market forces, especially as driven by US demands. Booms occur when demand increases and busts occur when demand collapses. This chapter argues, however, that the volatility of BC's forest economy is further affected by longer-term forces, and this period of volatility is part of a long period of crisis of structural adjustment. In this period, the plateau stage of the RILCM, noted by falldown effects, collided with the technological imperatives of the ICT. In turn, this collision spawned deep-seated forestry conflicts that helped spawn a battery of legislation that has radically changed industry practices and conventions. From industry's perspective, these changes have increased costs and added uncertainties, and are associated with a rationalization of commodity production compensated to some extent by the growth of value added segments. The implications of these costs and uncertainties for industry structures are explored in more detail in the next chapters.

4: RESTRUCTURING, SHAKEOUTS AND PLANT POPULATION DYNAMICS 1980-2008

4.1 Introduction

Plant population dynamics are an important theme in industrial life cycle models (ILCMs) that generally refer to the changing composition of plants (and firms) in terms of number, size, organization and market roles within an industry as it evolves over time. Within the economics literature, there has been special interest in the shakeout of plants in the rapidly growing stage, and the associated implications for industrial concentration and competitiveness (Mueller 2003, chapter 4). Within economic geography the 1980s recession stimulated a related interest in 'components of change' analysis that focused on employment and production change among a set of plants in a region before and after the recession (for example, Healey and Ilbery 1990). These studies typically focused on long established industrial regions and shakeouts that occur in mature stages to provide important insights into the nature of industrial decline, as well as possibilities for industrial renaissance. There is ongoing recognition that the decline and shakeout of a maturing industry maybe offset, however partially, by the start of a new cycle (Schamp 2005; Ter Wal and Boschma 2011). Potentially, new cycles may feature what may be termed 'shakeins' of new entrants. In BC's forest industries, these possibilities are reflected in the emergence of a dual structure characterized by the strategies of flexible mass production and flexible specialization (see Barnes and Hayter 1992; 1993; Hayter 1994; 1997; 2000; Nixon 1992).

This chapter examines the restructuring and related shakeouts (and shakeins) of BC's forest industries from the perspective of a plant population analysis. In particular, the aggregate industrial trends revealed in the previous chapter are disaggregated to the level of individual plants, and changes in their number and size within sub-industry categories are examined between 1980 and 2008 in terms of entry, exit and survival characteristics. Size is measured by employment and capacity, and the changes are documented by location. This analysis provides a micro-perspective of the implications of volatility for the industrial and spatial structure of BC's forest industries. For the purpose of this chapter, plant level changes occur as closures, the start-up of new operations, and by in-situ changes in size of operation (increase, decrease, stable). The organizational characteristics of plants are not explicitly incorporated, although in general, small plants are controlled by single-plant and small firms and large plants exist within multi-plant organizations. The organizational features of restructuring are examined in detail in the next chapter.

The main sources of information for this chapter are industrial directories. These sources provide data on production, plant size by capacity and/or employees, location, and sometimes ownership. Data was collected for the years 1980 and 2008, covering a time range of almost three decades. The year 1980 catches the state of the forest industry before the big crisis, while 2008 was the latest available year in spring 2009, when the analysis was conducted. Data was collected for the years 1980 and 2008 from the following sources: A list of forest factory sites compiled for the Canadian National Atlas 1980 by Roger Hayter, Scott's Directories of Western Manufacturers 1980/81 and 2008/09, BC Manufacturers Directory 1980 and 2009, Madison's Directory 1980/81 and 2008/09, and the BC Ministry of Forests' Major Primary Timber Processing Facilities in British Columbia 2008[10]. Industrial directories collect information about forestry plants given on a voluntary base. Usually, companies have to pay a fee for being listed. For advertising purposes, firms have an incentive to be registered in an industrial directory. Therefore, information for individual plants might have to be taken with caution, as one can think of various motives for over- or understating numbers. Furthermore, data in the directories is not updated every year and sometimes numbers are just carried over from one year to the next. For this reason, industrial directories are not a viable data source for the creation of longitudinal time series. Nevertheless, they provide a good sample of forestry plants to be compared over an extended period. The method applied in the following is a comparative static analysis; data from the industrial directories are compared between the years 1980 and 2008 in order to analyze trends and industrial dynamics.

The format of this the chapter is as follows. First, the growth and decline of sub-industries or industry segments are analyzed. Second, the analysis of plant population dynamics sheds light on openings and closures, changes in average plant size and the concentration of employment of capacity. Finally, shifts in the spatial pattern of the industry are evaluated based on entropy measures and the Andresen test for three different spatial scales.

[10] The publication only starts in 1983; therefore, no data is available for 1980.

4.2 Plant Population Dynamics

The data of individual plants allow the classification on a detailed scale and the classification used in the following is more specific than the SIC or NAICS classifications. Sawmills were classified into three categories: large mills with over 100 MMBF capacity per year or at least 150 employees, medium mills with less than 100 MMBF capacity and 31 to 150 employees and small sawmills with 30 or less employees[11]. Large board mills include factories producing panels, veneer, plywood and fibreboards, such as oriented strand board (OSB) and particleboard. Small board mills, such as specialty plywood producers were included in the value added wood category[12]. The classification includes logging establishments, pulp and paper mills as well as value added wood and paper industries.

There are 932 forest industry plants in the 1980 sample, compared to 1024 in the 2008 sample (table 4.1). The 359 plants that are present in both samples are survivors and a large number of plants either closed or opened. From 1980 to 2008, substantial shifts occurred with respect to the share of the different sub-industries. Thus, in 1980, sawmills (large, medium and small) accounted for more than half of all plants, this percentage decreased to about 1/3 in 2008. In the same time, the value added industries (wood and paper), increased their share from about 1/3 to more than half. There are minor changes with respect to logging, large board mills and pulp and paper mills. On average, employment is reported for about 65% of plants.

[11] Small sawmills usually do not provide information on capacity.

[12] For this reason, employment numbers in this chapter are not comparable with the numbers in table 3.5.

Table 4.1 Plant population analysis, sample size 1980 and 2008

	Number of plants (% of total plants)			Plants with employment Information (% of plants)		
	1980	**2008**	**Both years[1]**	**1980**	**2008**	**Both years[1]**
Logging	77 (8.3)	92 (9.0)	45 (58.4)	34 (44.2)	45 (48.9)	2 (4.4)
Large sawmills	131 (14.1)	68 (6.6)	63 (48.1)	96 (73.3)	47 (69.1)	45 (71.4)
Medium sawmills	134 (14.4)	79 (7.7)	48 (35.8)	90 (67.2)	50 (63.3)	23 (47.9)
Small sawmills	216 (23.2)	195 (19.0)	47 (21.8)	124 (57.4)	92 (47.2)	18 (38.3)
Large board mills	22 (2.4)	20 (2.0)	11 (50.0)	13 (59.1)	10 (50.0)	6 (54.5)
Value added wood	275 (29.5)	477 (46.6)	103 (37.5)	194 (70.5)	362 (75.9)	29 (28.2)
Pulp and paper mills	24 (2.6)	22 (2.1)	18 (75.0)	22 (91.7)	19 (86.4)	16 (88.9)
Value added paper	53 (5.7)	71 (6.9)	24 (45.3)	36 (67.9)	54 (76.1)	7 (29.2)
Total	932 (100.0)	1,024 (100.0)	359 (38.5)	609 (65.3)	679 (66.3)	146 (40.7)

[1] Percentage refers to the share of 1980 plants

Data: industrial directories

4.2.1 Plant Openings and Closures

Over time, the plant population was subject to substantial turnover (table 4.2). Overall, 573 plants closed down between 1980 and 2008, which represents over sixty percent of the 1980 sample. In the same time, 665 plants opened, which corresponds with 71.4% of the 1980 stock. Thus, the average “survival rate” of all plants (the share of plants that were in the 1980 sample and were still operating in 2008) is 38.5%.

That average rate varies notably across sub-industries. While small and medium sawmills and value added wood have survival rates below average, the values are above average for large sawmills, pulp and paper mills and board mills. In general, large plants are more likely to survive. The Pearson correlation coefficient between average plant size in 1980 and survival rate is 0.78 (significant at the 5% level).

Table 4.2 Plant population analysis, openings and closures 1980-2008

	# of plants			Closure rate[1]	Survival rate[2]	Opening rate[3]
	Closed	Surviving	Opened			
Logging	32	45	47	41.6	58.4	61.0
Large sawmills	68	63	5	51.9	48.1	3.8
Medium sawmills	86	48	31	64.2	35.8	23.1
Small sawmills	169	47	148	78.2	21.8	68.5
Large board mills	11	11	9	50.0	50.0	40.9
Value added wood	172	103	374	62.5	37.5	136.0
Pulp and paper mills	6	18	4	25.0	75.0	16.7
Value added paper	29	24	47	54.7	45.3	88.7
Total	**573**	**359**	**665**	**61.5**	**38.5**	**71.4**

[1] Percentage of 1980 plants that closed down until 2008
[2] Percentage of 1980 plants still operating in 2008
[3] Percentage of newly established plants, based on the number of plants in 1980

Data: Industrial directories

4.2.2 Plant size and Employment Concentration

Between 1980 and 2008, total employment in the sample declined by 43%. That trend differed substantially between the sub-industries, resulting in large shifts with respect to their relative employment share (table 4.3). Most sub-industries were subject to downsizing, only the value added wood and paper industries experienced absolute employment growth.

The share of logging stayed almost constant, this finding is supported by the total industry trend (figure 3.7). Large sawmills still employed the most people in 2008, in spite of losing more than 15,000 workers due to layoffs and mill closures. However, their share decreased from about forty to less than thirty per cent. The employment share of medium sawmills stayed about constant. Small sawmills increased their share but still only accounted for 3% of total employment in 2008. Thus, all sawmills (large, medium and small) combined accounted for 52.8% of total forest employment in 1980, and 40.7% in 2008.

Table 4.3 Plant population analysis, employment 1980 and 2008

	1980			2008			Change	
	N	Employment	% of total	N	Employment	% of total	#	%
Logging	34	2,040	3.2	45	1,201	3.3	-839	-41.1
Large sawmills	96	25,775	39.9	47	10,052	27.3	-15,723	-61.0
Medium sawmills	90	7,131	11.0	50	3,796	10.3	-3,335	-46.8
Small sawmills	124	1,251	1.9	92	1,141	3.1	-110	-8.8
Large board mills	13	5,506	8.5	10	2,191	5.9	-3,315	-60.2
Value added wood	194	3,681	5.7	362	8,680	23.6	+4,999	+135.8
Pulp and paper mills	22	18,022	27.9	19	8,115	22.0	-9,907	-55.0
Value added paper	36	1,203	1.9	54	1,673	4.5	+470	+39.1
Total	**609**	**64,609**	**100.0**	**679**	**36,849**	**100.0**	**-27,760**	**-43.0**

Data: industrial directories

Large board mills lost share. The value added wood industry grew by almost 5,000 employees and increased its employment share four-fold from about 6% to 24%, which makes it the second most important sub-industry. Pulp and paper mills lost almost 10,000 employees, but still accounted for more than 20% of total employment in 2008. The value added paper industry doubled its share to about 5% of total employment.

In general, large plants lost share to small, value added plants. In 1980, more than three out of four employees (75.7%) worked in large plants (large sawmills, large board mills, and pulp and paper mills); that ratio dropped to 55.2% in 2008. The share of small firms (small sawmills and value added wood and paper industries) increased from 9.5% to 31.2%. Those sheer numbers conceal the underlying qualitative changes regarding product mix, technology and plant organization.

The restructuring process becomes visible through considerable changes in plant size, measured by the average number of employees per plant (table 4.4). Logging operations downsized due to the shift from large corporate logging crews to small contractors. Likewise, large sawmills, large board mills, and pulp and paper mills decreased significantly in size. The two major reasons for this trend are declining export demand and increasing productivity due to changing technology and labour organization.

Table 4.4 Plant population analysis, changes in plant size 1980-2008

(Average number of employees per factory)

	Mean		Std. Dev.		Difference	
	1980	2008	1980	2008	2-tailed p-value	Significance
Logging	60.0	26.7	107.4	28.3	0.0497	5%
Large sawmills	268.5	213.9	184.2	94.7	0.0453	5%
Medium sawmills	79.2	75.9	62.3	57.7	0.7532	not significant
Small sawmills	10.1	12.4	9.3	9.1	0.0702	10%
Large board mills	423.5	219.1	244.7	117.5	0.0244	5%
Value added wood	19.0	24.0	29.2	45.4	0.1658	not significant
Pulp and paper mills	819.2	427.1	462.7	242.9	0.0020	<1%
Value added paper	33.4	31.0	38.1	35.7	0.7617	not significant

Data: industrial directories

Medium sawmills and the value added industries were not subject to statistically significant size changes. With the exception of value added wood industries, all standard deviations are declining, that measure reflects a reduced plant size variation within the sub-industries, which is evidence for the convergence to a best practice or industrial standard. Evidently, restructuring led to an evolutionary selection process, which worked in favour of plants with certain characteristics. A shakeout of plants occurred, reducing variation in size and likely with respect to other characteristics. On average, plants became smaller. Fixed costs, technology and economies of scale determine the minimum profitable size of an operation, while market and demand conditions along with high costs for transporting fibre set limits to expansion. Accordingly, the increased standard deviation within the value added wood industries means that size-variety increased as the segment grew and differentiated.

Gini coefficients are a measure of equality within a distribution (see Firebaugh 203, 77). In order to detect changes in employment concentration, the normalized Gini of employment was calculated for each sub-industry, for both years. Two findings are evident from table 4.5: First, employment concentration differs substantially across the sub industries. Second, the values remain surprisingly stable over time. The Gini for all plants in total is relatively high, representing the duality between relatively few large plants and numerous small ones. There are no major changes between 1980 and 2008, merely a slight decrease in concentration due to the closure of large plants and the opening of small establishments. The Ginis of the sub-industries also do not change dramatically over time, with the exception of logging.

Table 4.5 Plant population analysis, employment concentration 1980 and 2008

	Normalized Gini coefficient[1]	
	1980	**2008**
Logging	0.75	0.51
Large sawmills	0.34	0.24
Medium sawmills	0.38	0.38
Small sawmills	0.49	0.40
All sawmills	*0.64*	*0.61*
Large board mills	0.34	0.32
Value added wood	0.65	0.66
Pulp and paper mills	0.31	0.32
Value added paper	0.58	0.56
All plants	*0.74*	*0.71*

[1] Gini coefficient of 0: equal distribution of employment.
Gini coefficient of 1: all employment is concentrated in one plant

Data: industrial directories

There are large differences in employment concentration between the sub-industries, with logging and the value added wood and paper industries exhibiting the highest concentration (relatively few large establishments and many small plants). Concentration is lowest for large sawmills, board mills and pulp and paper mills in 2008. Because the subdivision of sawmills into three size classes might conceal changes in employment concentration, the Gini was also calculated for all sawmills combined. While the concentration is higher, due to the high employment share of large mills, it barely changes over time.

Employment concentration in logging decreased strongly, due to the dismantling of many large corporate logging crews and the shift towards small contractors. Apart from that, employment concentration stayed remarkably stable. This finding is somewhat surprising, taking into account the time span of almost three decades and the considerable downsizing that most sub-industries underwent. There is no sign of an increasing employment concentration at the plant level. Inequality even slightly decreased, both in total and in most sub-industries, which is another hint for a selection process that features the convergence towards an industrial standard. As mentioned above, plants cannot shrink below a certain size to remain profitable. Furthermore, this finding is in full support of a dual industry structure (Piore and Sabel 1984) which has become apparent in BC's forest industries (Edgington and Hayter 1997; Rees and Hayter 1996). During the study period, this dual structure is persisting and there is no evidence for major changes.

Employment concentration for both years is visualized using Lorenz curves (appendix A), which confirm the results above: a strong de-concentration in logging, not much change in the other sub-industries, at the most a slight de-concentration.

In order to highlight the effects of plant population dynamics on employment, employment change is decomposed into its elements. In such ways, net employment change is the sum of job loss due to plant closures, the jobs created in newly opened plants and the in-situ employment change in "surviving" plants (table 4.6).

Net employment decreased in all sub-industries, with the exception of the value added wood and paper industries. Overall, plant closures had a dramatic effect, accounting for the loss of more than 98% of 1980 employment in logging and more than 80% in small sawmills and value added wood. Closures were still responsible for more than half the job loss in large sawmills and board mills.

To a varying extent, jobs were created in newly established plants, especially in small plants such as logging, small sawmills and the value added industries. In the value added wood and paper industries, the number of newly created jobs exceeded the job loss due to closures, therefore the net job change was positive. In general, small firms experienced a higher dynamics; more jobs were created and destroyed than in large plants, which is evidence for a high selection pressure on newly established firms.

Table 4.6 Plant population analysis, decomposition of employment change 1980-2008

		Net employment change	Job loss in plant closures	In-situ job destruction	In-situ job creation	Jobs created in new plants
Logging	# of employees	-839	-2,003	0	3	1,161
Large sawmills		-15,848	-14,189	-4,037	1,888	262
Medium sawmills		-3,336	-5,080	-622	905	1,550
Small sawmills		-110	-1,044	-58	113	868
Large board mills		-3,590	-3,367	-924	93	608
Value added wood		5,000	-2,996	-171	266	7,901
Large pulp and paper mills		-9,907	-3,505	-6,772	50	320
Value added paper		469	-893	-52	99	1,316
Total		-28,161	-33,077	-12,636	3,417	13,986
Logging	% of 1980 employment	-41.1	-98.2	0.0	0.1	56.9
Large sawmills		-60.9	-54.6	-15.5	7.3	1.0
Medium sawmills		-46.8	-71.2	-8.7	12.7	21.7
Small sawmills		-8.8	-83.5	-4.6	9.0	69.4
Large board mills		-62.1	-58.2	-16.0	1.6	10.5
Value added wood		135.9	-81.4	-4.6	7.2	214.7
Large pulp and paper mills		-55.0	-19.4	-37.6	0.3	1.8
Value added paper		39.0	-74.2	-4.3	8.2	109.4
Total		-43.2	-50.8	-19.4	5.2	21.5

Data: industrial directories

In all sub-industries, except pulp and paper mills, considerably more jobs are lost due to mill closures than in-situ restructuring. Likewise, except in large sawmills the effect of in-situ job creation is smaller than that of newly opened plants. While in situ restructuring has strong implications for individual mills and communities (see Barnes et al. 1990; 2001; Barnes and Hayter 1992; 1997; Hayter et al. 1994; Hayter and Barnes 1992; 2001), those studies also emphasize the substantial conflicts arising from the rebuilding of a mill, especially with respect to unionized labour. Therefore, it is often the better alternative from a firm’s point of view to close down old, outdated mills and built new ones with up-to date equipment and re-negotiated collective agreements.

The employment decomposition demonstrates that the mere number of net jobs gained or lost in an industry is concealing the underlying processes of industrial dynamics or creative destruction, which lead to a considerably higher “gross” employment turnover. Entry and exit rates in industries and highly correlated. Thus, net entry is a small fraction of all entering firms (see Geroski 1995).

In such ways, more than twice the number of jobs that existed in 1980 were newly created in the value added wood industries, in the value added paper industries it was still more than 100%. Thus, even net employment growth involves the destruction of many jobs. In similar ways, to an extent even the downsizing of an industry includes newly created jobs.

Information about wages is not available from the industrial directories, but from other sources, such as Statistics Canada. In total, direct jobs in the forest industry generate about 3 billion of dollars in wages[13]. Forest industry jobs generally pay well; the average income in forest-based industries is 12% higher than in other industries (BCMoF 2011, 6). This is because many jobs are unionized, but it also reflects the tough labour conditions: physically demanding work, in the case of logging often in the outdoors, long hours and shift work, high risk of injuries and fatalities, remote forest communities. Furthermore, most jobs in the industry are highly productive. The significant higher wages in paper and allied industries in comparison to logging and wood manufacturing are rooted in higher skill levels of the workers (Schwindt and Heaps 1996, 61).

The wage differentials between primary manufacturing (sawmills, plywood, pulp and paper) and the value added industries are significant. An average employee in the value added wood industry earns about $10,000 less per year than workers in sawmill or plywood mills. Employees in the value added paper industries make about $20,000 less per year than in pulp and paper mills[14] (table 4.7). This gap has different reasons. Sawmills, board mills and pulp and paper mills operate on a large scale, involving enormous amounts of production capital and exploiting economies of scale. As mature industries, they have established products, routines and markets. Highly productive and capital intensive, they can pay high wages. Furthermore, as a heritage from Fordist days, many large firms and plants are unionized and high wages are part of the collective agreement. Union wages and benefits serve as a benchmark even for non-unionized plants. Most value added plants on the other hands, are small, non-unionized and labour intensive; that results in lower wages.

Therefore, the downsizing of large sawmills and pulp mills and the growth of the value added industries has important implications for the quality of forest industry jobs.

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[13] Natural Resources Canada, statistical data; http://canadaforests.nrcan.gc.ca/statsprofile (retrieved March 8, 2011).

[14] Those measures refer to the industry averages. Note that there exist large differences *within* each industry.

The jobs being lost are mainly “blue collar”, high paid and usually unionized; the jobs being gained in small mills are lower paid and non-union. This trend results in a greater spread of the wage distribution in the forest industries.

Table 4.7 BC forest industries, wages by sub-industry 1970-2009

(Average wage over all employees, 2002$)

	Wood product manufacturing			**Paper and allied industries**	
	Sawmills, planing and shingle mills	Veneer and plywood mills	Other wood industries	Pulp and paper mills	Other paper industries
1970	38,056	37,616	35,246	48,032	37,458
1980	54,763	51,337	40,401	62,968	44,256
1990	53,599	48,267	38,169	63,596	48,589
2000	48,613	49,643	34,464	67,492	45,592
2005	50.866	47.529	35.384	71.910	48.255
2009	48,460	44,102	35,760	68,777	46,887

Source: Statistics Canada, Principal Statistics (CANSIM tables 3010002, 3010003, 3010006)
CPI: CANSIM table 3260020

4.2.3 Plant Capacity and Capacity Concentration

Most large plants report capacity. The output of most large mills is quite standardized and of low unit value (such as dimension lumber, kraft pulp etc.). Therefore, the capacities of different mills are comparable and can be aggregated. There is not sufficient information for the other sub-industries; either capacity is barely reported such that sample sizes would be too small or (in addition) the plants are too heterogeneous, which is the case for the value added industries. Information on actual output is too variable to be used in this plant level analysis.

Average capacity of sawmills and pulp and paper mills did not change significantly (table 4.8). As explained above, the scale of a profitable mill does not allow for much variation. The lower capacity limit for a mill is set by technology and economies of scale. The over-capacities that were built up during Fordism were therefore mainly decreased through mill closures rather than in-situ capacity reduction in this time period, although downsizing can occur prior to closure.

Table 4.8 Plant population analysis, capacity change 1980-2008

	Sample size			Mean		Std. Dev.		Difference	
	1980	2008	Both years	1980	2008	1980	2008	2-tailed p value	Significance
Large sawmills[1]	126	64	58	186.7	196.1	91.2	90.8	0.502	not significant
Large board mills[2]	22	19	11	126.4	285.6	55.0	144.8	0.000	< 1%
Pulp and paper mills[3]	22	22	18	299.0	317.0	189.8	173.1	0.744	not significant

[1] Capacity is measured in millions of board feet (MMBF)
[2] Capacity is measured in millions of square feet, 3/8 base (MMSQF)
[3] Only pulp capacity is considered. Capacity is measured in millions of tons

Data: industrial directories

Large board mills more than doubled their 1980 capacity, mainly due to a shift of the product lines from veneer and plywood to particleboard and OSB. These results are especially insightful when combined with the findings from table 4.4. Large factories, such as large sawmills, board mills, and pulp and paper mills, reduced employment but increased capacity, which indicates rationalization and increasing productivity due to technology change along with the shift to more organizational flexibility.

Capacity concentration in large sawmills and pulp and paper mills is subject to a slight decrease, similar to employment concentration (table 4.9). The construction of new OSB mills in Fort Nelson, Dawson Creek and Fort St. John led to a slightly increased capacity concentration of large board mills. In general, capacity concentration remained remarkably stable.

Table 4.9 Plant population analysis, capacity concentration 1980 and 2008

	Normalized Gini coefficient[1]	
	1980	2008
Large sawmills	0.26	0.25
Large board mills	0.25	0.28
Pulp and paper mills	0.37	0.31

[1] Gini coefficient of 0: equal distribution of capacity
Gini coefficient of 1: all capacity is concentrated in one plant

Data: industrial directories

Equivalent to employment change, capacity change is decomposed into capacity lost due to plant closures, capacity created in newly opened plants and in-situ capacity change in surviving plants (table 4.10). Large sawmills lost about half their capacity, mostly due to plant closures. Relatively little capacity was newly created either in situ or in new mills, a clear evidence that large sawmills were consolidating. The large overcapacities built up during Fordism period had to be reduced due to declining demand. In similar ways, board mills are subject to considerable dynamics. A lot of capacity was lost in mill closures while surviving mills increased their capacity and new mills opened. Pulp and paper mills remained stable, without major capacity gains or losses.

Table 4.10 Plant population analysis, decomposition of capacity change 1980-2008

	Unit	Net capacity change	Capacity loss in plant closures	In-situ capacity loss	In-situ capacity creation	Capacity created in new plants
Large sawmills	MMBF	-11,333	-13,284	-2,186	3,413	739
Large board mills	MMSQF (3/8 base)	2,557	-1,799	0	1,708	2,648
Large pulp and paper mills	mill. of tons	506	-675	-1,368	1,638	911
Large sawmills	% of 1980 capacity	-47.8	-56.0	-9.2	14.4	3.1
Large board mills		89.1	-62.7	0.0	59.5	92.3
Large pulp and paper mills		7.8	-10.4	-21.2	25.3	14.1

Data: industrial directories

4.2.4 Productivity

As industrial directories do not provide reliably information about the actual production of a mill in a particular year, a proxy for productivity was calculated using mill capacity. Although this measure is likely to overstate the actual productivity (for example. measured in output per worker or per hour worked), a sufficient proxy for the productivity trend is obtained by comparing the numbers for 1980 and 2008. In order to calculate productivity, both employment and capacity data of a plant were necessary, sample sizes are still well above 50%.

Productivity increased significantly in all three sub-industries (table 4.11). For the most part, that trend is rooted in considerable employment reduction. These findings are in line with the industrial trend and confirm that the job generation potential of mass production is declining (section 3.3).

Table 4.11 Plant population analysis, productivity change 1980-2008

	Sample Size			Mean		Std. Dev.		Difference	
	1980	2008	Both years	1980	2008	1980	2008	2-tailed p value	Significance
Large sawmills[1]	100	49	40	0.85	1.02	0.41	0.47	0.025	5%
Large board mills[2]	14	11	6	0.42	1.41	0.20	0.58	0.000	< 1%
Pulp and paper mills[3]	21	19	16	0.36	1.00	0.04	0.62	0.000	< 1%

[1] Productivity is measured in millions of board feet (MMBF) per employee
[2] Productivity is measured in millions of square feet, 3/8 base (MMSQF) per employee
[3] Only pulp capacity is considered. Productivity is measured in millions of tons per employee

Data: industrial directories

4.3 Shifts in the Spatial Pattern of Production

4.3.1 Differences between Coast and Interior

Coast and Interior comprise BC's large traditional forest regions; they differ fundamentally in many aspects. In the temperate and humid Coastal forests the dominant species are cedar, Douglas fir and hemlock; the Interior, very differentiated in itself, has a drier continental climate, from temperate to sub-boreal with spruce, pine and fir dominating. The two regions have different industrial histories, trade relations, and union cultures (see Hak 2007).

For the longest time, the centre of gravity for BC's forest industry was located on the Coast. Coastal logging started in the second half of the 19th century (see Hak 1999). For a long period, the key advantage of the Coast were large stands of high value, old growth forest, easily accessible by tidal waters. That began to shift in the 1970s, when the falldown effect set in and the public become increasingly aware of the temperate rain forests' importance for biodiversity. The Coast was the main theatre for the War in the Woods and was more severely affected by restructuring and crises than the Interior. Compared with Interior mills, Coastal sawmills produce an outdated wood product mix and labour costs on the Coast are among the highest worldwide (Woodbridge Associates 2009). In comparison, Interior mills are larger and more modern, as the region received major investment due to the availability of large stands of timber infested by the MPB.

The long established Coastal trade connections with Japan have been gradually declining since the 1997 Asian Crisis. The falldown effect is more severe on the Coast, as there are larger differences in wood value between old and second growth. Although Coastal timber is generally of higher value and not affected by the MPB, that is not reflected in the industry's profit margins due to higher stumpage rates.

As a consequence, the industrial plant population differs considerably between Coast and Interior (table 4.12). In 1980 the Coast had a larger share of medium sawmills, pulp and paper mills and the value added industries. More than half of logging establishments, large and small sawmills and board mills were located in the Interior. Almost 60% of forest employment was concentrated on the Coast. With the exception of large sawmills, all sub-industries employed more people on the Coast than in the Interior.

Table 4.12 Plant population analysis. Plant numbers and employment 1980 and 2008, BC Coast and Interior

		% of plants		% of employment		% of capacity	
		Coast	**Interior**	**Coast**	**Interior**	**Coast**	**Interior**
1980	Logging	42.9	57.1	55.3	44.7	N/A	
	Large sawmills	35.1	64.9	45.3	54.7	39.6	60.7
	Medium sawmills	58.2	41.8	63.0	37.0	N/A	
	Small sawmills	42.6	57.4	54.4	45.6	N/A	
	Large board mills	45.5	54.5	57.0	43.0	58.4	41.6
	Value added wood	67.6	32.4	77.6	22.4	N/A	
	Pulp and paper mills	58.3	41.7	68.1	31.9	62.3	37.7
	Value added paper	94.3	5.7	93.0	7.0	N/A	
	Total	**54.6**	**45.4**	**57.9**	**42.1**	N/A	
2008	Logging	44.6	55.4	58.0	42.0	N/A	
	Large sawmills	23.5	76.5	14.9	85.1	21.4	78.6
	Medium sawmills	65.8	34.2	66.1	33.9	N/A	
	Small sawmills	55.9	44.1	52.1	47.9	N/A	
	Large board mills	15.0	85.0	26.2	73.8	16.1	83.9
	Value added wood	66.0	34.0	74.0	26.0	N/A	
	Pulp and paper mills	40.9	59.1	56.4	43.6	32.7	67.3
	Value added paper	90.1	9.9	84.9	15.1	N/A	
	Total	**59.5**	**40.5**	**49.7**	**50.3**	N/A	

Data: industrial directories

This picture has changed considerably, as the Coast declined and by 2008, more than half of total employment was located in the Interior. As demonstrated above, plant closures were the dominant factor in this relative employment shift, with the Coast experiencing significant closures of large sawmills and board mills. In 2008 more than ¾ of large sawmills were located in the Interior, employing 85% of the workers, the situation is similar for large board mills. The Interior increased its employment share in all sub industries. The two exceptions are medium sawmills (that gained employment on the Coast) and logging (that did not change much). In contrast, the value added industries are still concentrated on the Coast.

In 2008, slightly more than 20,000 employees worked in large plants (large sawmills, board mills and pulp and paper mills) more than 2/3 of them in the Interior. In similar ways, capacity shifted and in 2008, more than 2/3 was located in the Interior.

The shift in plant numbers and employment is rooted differences between Coastal and Interior regarding openings and closures (table 4.13). Closure rates of large sawmills, large board mills, and pulp and paper mills are higher on the Coast. Survival rates for small and medium sawmills are higher on the Coast. More small sawmills were built on the Coast while more large board mills and pulp and paper mills emerged in the Interior.

Table 4.13 Plant population analysis, opening and closure rates, BC Coast and Interior

		Closure rate[1]	**Survival rate[2]**	**Opening rate[3]**
Coast	Logging	30.3	69.7	54.5
	Large sawmills	69.6	30.4	4.3
	Medium sawmills	57.7	42.3	24.4
	Small sawmills	73.9	26.1	92.4
	Large board mills	80.0	20.0	10.0
	Value added wood	62.4	37.6	131.7
	Pulp and paper mills	42.9	57.1	7.1
	Value added paper	58.0	42.0	86.0
Interior	Logging	50.0	50.0	65.9
	Large sawmills	42.4	57.6	3.5
	Medium sawmills	73.2	26.8	21.4
	Small sawmills	81.5	18.5	50.8
	Large board mills	25.0	75.0	66.7
	Value added wood	62.9	37.1	144.9
	Pulp and paper mills	0.0	100.0	30.0
	Value added paper	0.0	100.0	133.3

[1] Percentage of 1980 plants that closed down until 2008
[2] Percentage of 1980 plants still operating in 2008
[3] Percentage of newly established plants, based on the number of plants in 1980

Data: industrial directories

4.3.2 Spatial Concentration

As demonstrated above, plant closures have played a dominating role in the restructuring of BC's forest industry since 1980, and the closures of large operations have been especially evident in the Coastal region. This section explores changes in the spatial concentration of plants using entropy measures and the Andresen test.

Regional entropy is a global measure for the spatial concentration across a given set of areal units. It can be normalized into relative regional entropy, which takes values between 0 and 100 (Rice and Lavoie 2005). Entropy is calculated using the following formula (see Johnston and Semple 1983).

$$H = \sum_{i=1}^{n} p_i \ln\left(\frac{1}{p_i}\right)$$

$$\hat{H} = \left(\frac{H}{\ln n}\right) 100,$$

where H is the absolute entropy of the system, p_i is the proportion of all elements of a particular database that fall within class i; in this case the number of plants in a spatial unit; n is the total number of classes (the number of spatial units). $\hat{H}$ is the relative entropy, the fraction of the maximum possible entropy of the system. An $\hat{H}$ value of 0 means perfect concentration; all plants are located in the same spatial unit. A value of 100 means perfect dispersion; all spatial units have an equal share of plants.

The Andresen (2009) test is a recently developed Monte Carlo method for analyzing spatial patterns (see Andresen 2009; 2010; Andresen and Malleson 2011). The test provides both a global (the index of similarity) and a local output (obtained through the mapping of the test results). The testing process includes the following steps (Andresen 2009, 337):

- Starting point of the analysis is a point pattern distributed over a set of areas, in this case the production sites in 1980.
- From this pattern, 85% of the points are randomly selected and allocated to the areas. This procedure yields a new spatial pattern.
- The simulation in step 2 is repeated many times. In such ways, one obtains a distribution of points for each area. By cutting off the upper and

lower tails, a non-parametrical confidence interval is calculated; 200 repetitions yield a 95% confidence interval.

- The testing point pattern (in this case the production sites in 2008) is compared with the outcome of the simulation. The percentage of points can either lie within the confidence interval (no significant change), or can be significantly higher or lower.
- Based on the test result for each area, the index of similarity is calculated as a measure of how similar the two point patterns are:

$$S = \frac{\sum_{i=1}^{n} s_i}{n},$$

where s_i is equal to 1 if the number of plants in area i is similar in 2008 to the pattern in 1980 and s_i is equal to 0 if the pattern is not similar; n is the number of spatial units. The S-index is therefore defined to lie between 0 and 1, where 0 means that the pattern has changed in all areas (perfect dissimilarity) and 1 means that there is no change in any area (perfect similarity). Thus, the S-Index represents the percentage of spatial units that have a similar percentage of plants in both years.

The Andresen-test and spatial entropy are useful complements. Changes in spatial entropy indicate changes in the spatial concentration of an industry, but they do not reveal how the spatial pattern has changed (i.e. where the change occurs) If region A has 20% of the factories and region B 80%, spatial entropy will remain constant if 60% of the plants relocate from B to A. The Andresen-test will detect such changes in the spatial pattern, because the similarity is analyzed with respect to each region, but the test does not measure changes in the overall spatial concentration.

A known problem with the use of area-based tests is their potential susceptibility to the modifiable areal unit problem or MAUP (Openshaw 1984). Analytical results tend to be sensitive to the definition of the spatial units for which the data is reported (Fotheringham 1998, 286). The MAUP can occur in two possible ways. First, there might be a quantitative change in any test results: the qualitative nature of the results will not change, but the significance or magnitude of a statistical test may change. Second, the qualitative nature of the results might change, making the entire analysis questionable. The most common form of sensitivity analysis regarding the MAUP is to conduct the analysis at multiple scales, to shift the zone boundaries, or to change the shape of the zone boundary (Andresen 2009, 335).

Thus, in order to provide a sensitivity analysis to the MAUP, the following analysis is conducted at two different geographical scales: at the regional level, the three Forest Regions are used. Furthermore, the test statistics is calculated for the 28 Regional Districts and the 29 Forest Districts. Those spatial units were chosen for reasons of practicability. They are purely administrative regions and not likely to have any influence on the location pattern of the forest industry, albeit they might correlate with some underlying geographical features that have an impact on industrial dynamics, such as species distribution, climate, or the MPB. Those spatial units change frequently due to policy revisions; the Forest Regions and District reflect the state of 2003. The Regional Districts were last changed in 1995[15].

Both regional entropy and the Andresen test are area based methods, thus the limitations of point pattern tests are avoided. Due to the spatial structure of British Columbia, such tests would face considerable restrictions. First, the location information obtained from the database is only available at the level of 6-digit postal codes. In BC, postal code areas differ substantially in size dependent on population density, which would substantially bias the results of distance-based point pattern tests. Another problem with distance-based tests is the occurrence of edge effects. A large number of forestry plants are located along the borders of British Columbia, especially in the southern part of Vancouver Island and the Lower Mainland, which would make such testing problematic. Area based tests are not sensitive to edge effects.

In general, the spatial concentration, measured by regional entropy, remains quite stable over time at all geographical scales, with few changes from 1980 to 2008 (table 4.14). That result is remarkable in view of the large number of plants closing down, employment turnover and the shift from the Coast to the Interior. At the level of the Forest Regions, entropy values close to 100 indicate high dispersion across regions in most sub-industries; the only exception is value added paper, which is highly concentrated on the Coast (51 out of 54 plants).

[15] In 2008, the Comox-Strathcona Regional District was divided into the two Regional Districts Comox Valley and Strathcona. These changes are not considered in this thesis.

Table 4.14 Plant population analysis, regional entropy 1980 and 2008

(Relative regional entropy[1])

	Forest Regions (n=3)		**Forest Districts** (n=29)		**Regional Districts** (n=28)	
	1980	**2008**	**1980**	**2008**	**1980**	**2008**
Logging	96.3	97.4	81.7	85.9	90.3	91.3
Large sawmills	98.3	99.3	83.9	84.5	83.3	82.6
Medium sawmills	85.2	76.3	66.9	58.0	74.6	70.2
Small sawmills	88.4	79.6	78.5	75.8	86.8	86.9
Large board mills	76.2	85.3	61.3	73.8	63.6	74.6
Value added wood	74.3	72.3	46.7	55.8	59.2	69.6
Pulp and paper mills	87.3	97.4	75.3	73.4	76.5	75.8
Value added paper	19.5	29.6	10.1	18.1	11.2	22.8

[1] Entropy value of 0: absolute concentration (all plants in a single region)
Entropy value of 100: absolute dispersion (equal share of plants in each region)

Data: industrial directories

Concentration of logging, large sawmills and the value added wood industries hardly changes over time. To an increasing extent, medium and small sawmills are concentrated on the Coast. Large board mills and pulp and paper mills experience a slight decrease in spatial concentration as more plants shut down on the Coast. Entropy of value added paper increases as more plants open in the Southern Interior.

At the level of the Forest Districts and Regional Districts, entropy values are similar, which shows that the spatial pattern of the forest industry is quite resilient to boundary changes of spatial units at the district level. Logging, large and small sawmills and pulp and paper mills exhibit a high degree of dispersion with few changes over time. Large board mills are subject to increasing dispersion due to the closure of mills in the Lower Mainland and the opening of several new OSB mills in the Peace River and Northern Rocky Mountains Regional Districts.

The value added wood industries exhibit a high degree of spatial concentration, especially in the Lower Mainland and the lower Fraser Valley; However, value added industries emerged in several other urban centres, such as the Okanagan, Kamloops and Victoria, which decreased the dominance of the Lower Mainland.

Medium sawmills exhibit a distinct spatial pattern that is different from both large and small mills. Large sawmills are dispersed across virtually all parts of the province. Small sawmills consist of a mix of small “mom and pop” or ”backyard” mills (in parts a leftover from pre-Fordist days) which meet local demand and highly specialized value added sawmills at the other end of the spectrum. Medium sawmills are increasingly spatially concentrated in a few favourable regions, especially the Lower Mainland and around Kamloops that implies that the sub-industry shifted away from the fibre-base towards more value added production, which is reflected in a changing set of location factors.

The value added paper industry shows the highest concentration, with over 80% of plants located in Greater Vancouver in 2008. However, new plants opened in other urban centres across BC, such as Victoria and Kelowna, slightly reducing the dominant position of the Lower Mainland.

4.3.3 Spatial Dynamics: Global Result of the Andresen-Test

Table 4.15 indicates the global Andresen-test results, the indexes of similarity for the eight sub-industries in each of the three sets of spatial units. From these results, it is evident that the highest dynamics (the least similarity in the location pattern between 1980 and 2008) takes place at the scale of the three Forest Regions. An S-index of 0 means that that the relative share of plants did change in all of the three regions, whereas a S value of 0.33 means that the share changed in two of three regions. This is not surprising, as those regions are characterized by large differences with respect to geography and industrial history.

There is substantial difference in spatial dynamics across the sub-industries. Forest Districts and Regional Districts yield very similar results, showing that the analysis is quite resilient to boundary changes at that scale. An exception is logging, this result is probably rooted in the small sample of logging operations. In general, the S-values are higher for large plants, indicating a more stable spatial pattern.

Pearson correlation coefficients between the s_i-measures of all sub-industries were calculated in order to test for similarities between of the sub-industries' spatial patterns at the scale of Forest Districts and Regional Districts. There is only a single significant correlation: a modest positive relationship (r = 0.386) at the level of the Forest Districts between the patterns of small sawmills and value added wood industry. Forest Districts with a higher percentage of small sawmills in 2008 than in 1980 also tend to have a higher share of value added wood industry, which is not surprising, given many newly established sawmills are value added specialty producers. The s-values of all other sub-industries seem to be independent. That result demonstrates that the sub-industries are subject to substantial variation in their location dynamics and to different evolutionary patterns.

Table 4.15 Plant population analysis, Andresen (2009) test results 1980 and 2008
(S-indices[1])

	Forest Regions (n = 3)	**Forest Districts** (n = 29)	**Regional Districts** (n = 28)
Logging	0.33	0.31	0.71
Large sawmills	0.33	0.59	0.43
Medium sawmills	0.00	0.45	0.43
Small sawmills	0.00	0.35	0.43
Large board mills	0.00	0.79	0.79
Value added wood	0.00	0.48	0.39
Pulp and paper mills	0.33	0.76	0.82
Value added paper	0.33	0.83	0.82

[1] The S-index measures the similarity of the spatial plant pattern, 1980 and 2008. An S value of 1 means perfect similarity, each region has a similar proportion of plants in 2008 compared to 1980. An S value of 0 means perfect dissimilarity, each region has a different proportion of plants in 2008 compared to 1980

Data: industrial directories

4.3.4 Local Hot Spots

While the global result of the Andresen test indicates the overall “stability” of a spatial point pattern over time, the test also reveals local spatial relationships (see Anselin 1995; Fotheringham 1997; Fotheringham and Brunsdon 1999; Getis and Ord 1992; 1996; 2010; Ord and Getis 1995). In such ways, it is possible to detect exceptions in global patterns, such as local variations or hotspots. For that purpose, the test results were mapped (appendix C). For each spatial unit, there are three possible outcomes: an s-index of 1 (the percentage of plants is higher in 2008 than in 1980), a value of -1 (proportionally less plants in 2008 than in 1980) or an index of 0 (no significant difference between 1980 and 2008). The hotspots revealed by the Andresen-test indicate regions of higher resilience (less plants closing down or more plants opening).

A remarkable result is that each sub-industry has its particular local hot spot or region of greater resilience. Those hot spots are different for each sub-industry. First, this result confirms that the applied data classification is justified, particularly the division of sawmills into three size classes, because each sub-industry is subject to its own location dynamics. Second, the Andresen-test turns out to be a useful method to analyze the spatial plant population pattern and detect local hot spots.

Logging yields inconclusive results, due to the relatively low representation of establishments in the sample. Large sawmills shifted away from the Coast; because more mills closed down; due to the investment in new mills and technology, concentration increased in the Interior. An increased percentage of mills is located in the Cariboo (Prince George, Quesnel, Williams Lake) and Bulkley-Nechako Regional Districts (Smithers, Vanderhoof, Houston). This trend is associated with the substantial amount of beetle wood available for harvest (Bogdanski et al. 2011).

Medium sawmills shifted towards the Coast, against the general industry trend. Hot spots of increased concentration are the Lower Mainland and the Thompson Nicola Regional District (around Kamloops). An increased percentage of small sawmills is located on Vancouver Island and in a few locations in the Southern Interior, such as the Kootenay Boundary Regional District.

A hot spot for large board mills is located in the Northern Rockies Regional District due to the opening of new OSB mills in Fort Nelson, Dawson Creek and Fort St. John. The Coastal share of value added wood industries is decreasing in spite of an absolute increase in numbers. The concentration in the Lower Mainland and the Okanagan, the sub-industry's traditional strongholds, is declining and new value added mills opened across Vancouver Island and virtually across the entire Southern Interior. The hot spot of the pulp and paper industry is the Cariboo Regional District, which relates to the surviving mills in Prince George and Quesnel.

Similar to the value added wood industries, the value added paper industries lost share in the Lower Mainland, although it was still the sub-industry with the highest concentration in 2008. The Capital Regional District (around Victoria) seems to be the sub-industry's hot spot.

Overall, a lower percentage of plants are located on the Coast in 2008 compared with 1980, especially the Lower Mainland is starting to lose its dominating position. Large differences in the location pattern of the sub-industries become evident.

4.4 Conclusion

The information collected from industrial directories for the years 1980 and 2008 yields a series of important results with respect to employment, capacity, and location pattern. BC's forest industry is highly dynamic and characterized by openings, closings, and a high employment turnover. Even in downsizing subsectors new plants open and some jobs are created. Despite the high turnover of jobs and plants and the downsizing of the industry in terms of employment, concentration of employment and capacity remained remarkably stable between 1980 and 2008. This finding is clear evidence for a persisting dual industry structure, characterized by relatively few large plants and many small ones. This duality persisted from 1980 to 2008, as the industry evolved from Fordism to flexible mass production and flexible specialization. In such ways, we see a dual evolution, or the evolution of duality, which resulted in the emergence of two main industry segments, distinguished by size, dynamics, and location factors.

The first segment consists of large plants relying on the strategy of flexible mass production, such as large sawmills, board mills, and pulp and paper mills; they produce commodities such as dimension lumber, OSB, pulp, and newsprint. Technology improvements and new forms of labour organization led to enormous productivity gains, which resulted in consolidation, downsizing, and the correction of excess capacities; both employment and plant numbers are declining. The crucial location factor in that segment is proximity to the fibre supply; therefore, the location pattern is characterized by a high degree of dispersion. Despite the de-coupling of production from timber supply and the closure of many mills, this pattern generally persists and plants, especially large sawmills, are located in all regions of the province. Hotspots of higher resilience are the Cariboo and Bulkleen-Nechako Regional Districts (for large sawmills and pulp and paper mills) and the Northeast of the province (for large board mills).

The second segment is comprised by small and medium sawmills and the value added wood and paper industries, producing a wide range of high-value secondary wood and paper products, using strategies of flexible specialization. This segment mainly consists of small single-plant firms, most of them with less than 50 employees. The segment is growing in terms of sales, plant numbers, and employment. However, wages in the second segment are considerably lower and high closure rates lead to a high turnover of jobs. As most plants in that segment lack an own timber tenure, fibre supply is less important as a location factor compared to the proximity to customers, business services, and related, complementary firms. For these reasons, the segment is highly spatially concentrated. In the past, clusters of value added firms were essentially confined to the Lower Mainland and to some extent the Okanagan. However, that pattern is changing as new plants have emerged in smaller urban centres on Vancouver Island and across the Southern Interior.

5: THE SURVIVAL OF A DINOSAUR: THE RESTRUCTURING OF CANFOR

5.1 Introduction

For almost forty years, from the 1940s until the 1980s, corporate strategies emphasized the imperatives of Fordism. During this time BC's forest economy was dominated by the same large horizontally and vertically integrated corporations that produced large shares of the log harvest, wood products (lumber, plywood, shingles and shakes) and paper and allied products (pulp, newsprint, and converted paper products). According to Schwindt (1979), these firms were highly conservative, path-constrained "vertically integrated dominants" strongly rooted in a mass production, export and commodity culture, very slow to change. In the context of the US Pacific Northwest, Brunelle (1990) made the same observation, emphasizing how slow the big forest firms had been to cope with the recession beyond cost cutting. More generally, business writers have labeled large vertically integrated resource firms as dinosaurs because of their apparent inabilities to diversify outside of their established industrial boundaries (Levitt 1965; Lawler and Galbraith 1994). This label has also been attached to BC's forest product giants (Hayter 2000, 108). Nevertheless, the 1980s recession and its volatile aftermath threatened extinction and the lead dinosaurs from the Fordist period have all failed, with one exception: Canfor. Why?

The world of Fordist dinosaurs in BC's forest economy came crashing down in the early 1980s, when the devastating recession undermined corporate profitability and production at a time when the industry had reached the plateau stage of the RILCM and long-held assumptions about fibre supply were threatened. Indeed, the 1980s recession was a turning point in industrial organization and especially for the vertically integrated dominants of Fordism, leading to strategic rethinks and a radical selection process. Indeed, among the top five Fordist dominants only Canfor (originally Canadian Forest Products Company) has survived to become the largest corporate entity in BC's forest economy. Foreign ownership has also declined since 1980. The role of the vertically integrated dominant firm has been severely compromised, if not entirely over-thrown.

This chapter addresses the changing industrial organization of mass production in BC's main forest industries, paying particular attention to the survival of Canfor. Has

Canfor survived by remaining a dinosaur, or has it changed its ways. How different are the new large firms from the old Fordist dinosaurs?

The reasons for the failure of other Fordist dominants are noted, especially Macmillan Bloedel (MB), for a long time the leading Fordist dominant and like Canfor a BC-based company until its takeover by Weyerhaeuser in 1999. The chapter is structured into three parts. First, aggregate trends in corporate restructuring 1975-2010 are analyzed, noting important changes in the leading companies and in foreign ownership. Second, the chapter explores the corporate strategy of Canfor in order to reveal the crucial factors of the company's ability to survive. This case study relies primarily on information published in the firm's annual reports. Those reports are available since 1983 and contain data from 1979. Finally, Canfor's survival is set in contrast to the demise of MB and the reasons for the companies' different development paths are discussed.

5.2 Aggregate Trends in Corporate Restructuring

5.2.1 Corporate Structure during Fordism

Corporate growth in BC's forest economy during Fordism was oriented towards the development of large-scale primary processing facilities supplying export markets. The "ideal" Fordist firm was not only big, but also integrated across the full range of forest products, producing dimension lumber, plywood, shingles and shakes, pulp, newsprint and paperboards. Horizontal integration enhanced market power and created firm level economies of scale, such as in the use of marketing networks, production know-how and R&D. Vertical integration alleviated the control over timber supply and market links. In such ways, integrated firms were considered the best industrial model, which would convert logs to the best and highest-value use. Vertical integration also provided a certain amount of stability against the price and demand fluctuations of the different forest commodities (Hayter 2000, 55). This tendency was supported by the availability of substantial timber supplies, by the trend toward higher levels of timber utilization, and by the limits to forward integration due to relatively small-scale and dispersed markets that constrained the distances over which internal linkages could be economically maintained (Hayter 1976, 217).

Between 1950 and 1977 a considerable number of foreign companies entered British Columbia's forest sector by the establishment of both majority owned subsidiaries and joint ventures. Thus, the industry was dominated by foreign subsidiaries and "truncated" firms (Hayter 1981; 1982). Pearse (1976) estimated that 34% of the leased timber supply was controlled by foreign firms while all externally controlled firms controlled just more than half. In 1975, six of the ten largest firms and sixteen of the largest twenty forest product firms were foreign or externally controlled.

In such ways, Fordism led to the development of a characteristic corporate structure. Relatively few large, horizontally and vertically integrated corporations, many of them under external control, dominated the industry and controlled a large share of the timber harvest. In 1975, the ten largest firms controlled more than 40% of the AAC. In the terms of David (2001, 26), the industry had become locked into a "*basin of attraction*" or "*stable equilibrium*", which resulted in particular organizational structures and strategies. According to David, such a t situation could only change through a disruptive "*external force*" or "*shock*" (ibid. 26). Martin and Sunley (2006) similarly emphasize the importance of external shocks, such as booms and busts, in re-directing path dependent behaviour.

The Fordist production system started to reveal exhaustion as a result of productivity increases during the 1970s. Overcapacities in connection with low per-unit value products led to a worsening financial situation of the forest industry. The corporate structure, however, made it extremely difficult to respond to low returns. First, the bulk of revenues stemmed from products that were the result of a sequence of vertically integrated processes. Therefore, the industry was committed to process rather than product innovation, which made it difficult to transfer technology to new lines of business. Second, the sheer size of companies implied that the scale of new investment projects had to be large to be reflected in corporate success. Low price-earnings ratios made such substantial investments quite difficult. Third, the attitudes and organization structure of vertically integrated firms were adverse to diversification and change (Schwindt 1979, 21f).

The lock-in into the Fordist production system was strong and the obvious failure of the leading firms in the forest industry to respond to those changes suggests that it had become trapped and lost its ability to endogenously evolve (Martin and Sunley 2006, 12), Thus, a change of the corporate system had to come from outside. A key question arises as to whether the profound exogenous shocks experienced by the industry for at least three decades, summarily illustrated by highly volatile production trajectories (chapter 3), have had the effect of changing long established attitudes.

5.2.2 The Turnover of Leading Firms

The 1980s crisis with its implications for radical change led to a somewhat paradoxical situation for the Fordist dinosaurs. Dramatic losses resulted in mass layoffs and mill closures, the imperatives for change signalled by the recession were widely noted. Particular concerns were expressed in several reports about an over-emphasis on low-priced commodities when costs were high and rising, consistent with the plateau effects of the RILCM, and when plant and machinery had become obsolete, especially on the Coast. Yet change was not easily implemented. The crisis imposed severe financial constraints to companies, which impeded new investment projects, although it had a big immediate effect on cost cutting, downsizing and the sale of assets.

The 1980s crisis and the subsequent period of volatility led to a considerable turnover of companies (table 5.1). Major firms entered the market, withdrew from the province, or were taken over by competitors. From the top ten companies in 1975, only two are in the 1990 list and only a single one – Canfor – was still operating in 2009, the rest had closed down, withdrawn from the province, or merged with other firms. Significant changes in the degree of foreign ownership are reflected by the fact that in 1975 six of the top ten companies were foreign controlled, compared to only two in 1990. Since the 1970s, foreign companies started to withdraw from BC. While some of those exits can be attributed to corporate failure (Hayter 2000, 170), most are planned and strategic. Marchak (1983) explains that trend with the declining competitive position of BC's forest industry and low returns to capital. Hayter (2000, 172) states that due cash flow and debt problems during the 1980s crisis, many US-based corporations focused on their domestic business and sold foreign subsidiaries (ibid. 172). Certainly, institutional change and the resulting BC discount factor had a significant influence as well. Today, the industry is increasingly under domestic control, this trend reflects the low returns on capital and the gloomy perspective of the industry. Although the province lost MacMillan Bloedel, its long-time Fordist giant, today four of the five largest forest companies are domestically controlled: Canfor, Western Forest Products, Tolko and Interfor. Only West Fraser is controlled by US capital. However, West Fraser is an unusual foreign corporation as its owners live in Seattle but until very recently most of its assets were in BC. The top ten AAC holders in 2010 display the changes in the industry. Such for instance, BC Timber Sales controls the largest share of AAC, which reflects the rising importance of small and medium enterprises. The multiple uses of BC's forest resources is mirrored by the fact that a large share of AAC is held by RPP, a Vancouver-based international holding company investing in renewable energies.

Table 5.1 Top ten holders of AAC in BC, selected years

(Foreign controlled firms in bold)

Rank	1975	1990	1999	2010
1	MacMillan Bloedel	**Fletcher Challenge**	Slocan Forest Products	BC Timber Sales
2	**BC Forest Products**	MacMillan Bloedel	MacMillan Bloedel	Canfor
3	BC Cellulose	Canfor	Canfor	Western Forest Products
4	Canfor	**West Fraser Mills**	**West Fraser Mills**	**West Fraser Mills**
5	Northwood	**Weldwood**	Doman	Tolko
6	**Crown Zellerbach**	Noranda	Interfor	Interfor
7	**Rayonier**	Doman	Northwood	Tembec Industries
8	**Weldwood**	Slocan Forest Products	Riverside Forest Products	**Lousiana Pacific Canada**
9	**Eurocan**	Westar	Skeena Cellulose	RPP Holdings
10	**Tahsis**	Interfor	**Weldwood**	Abitibi Consolidated

Source: Top 10 companies 1975: Pearse (1976); 1990 and 1999: BCMoF (2007b); 2010: BCMoF (2011).

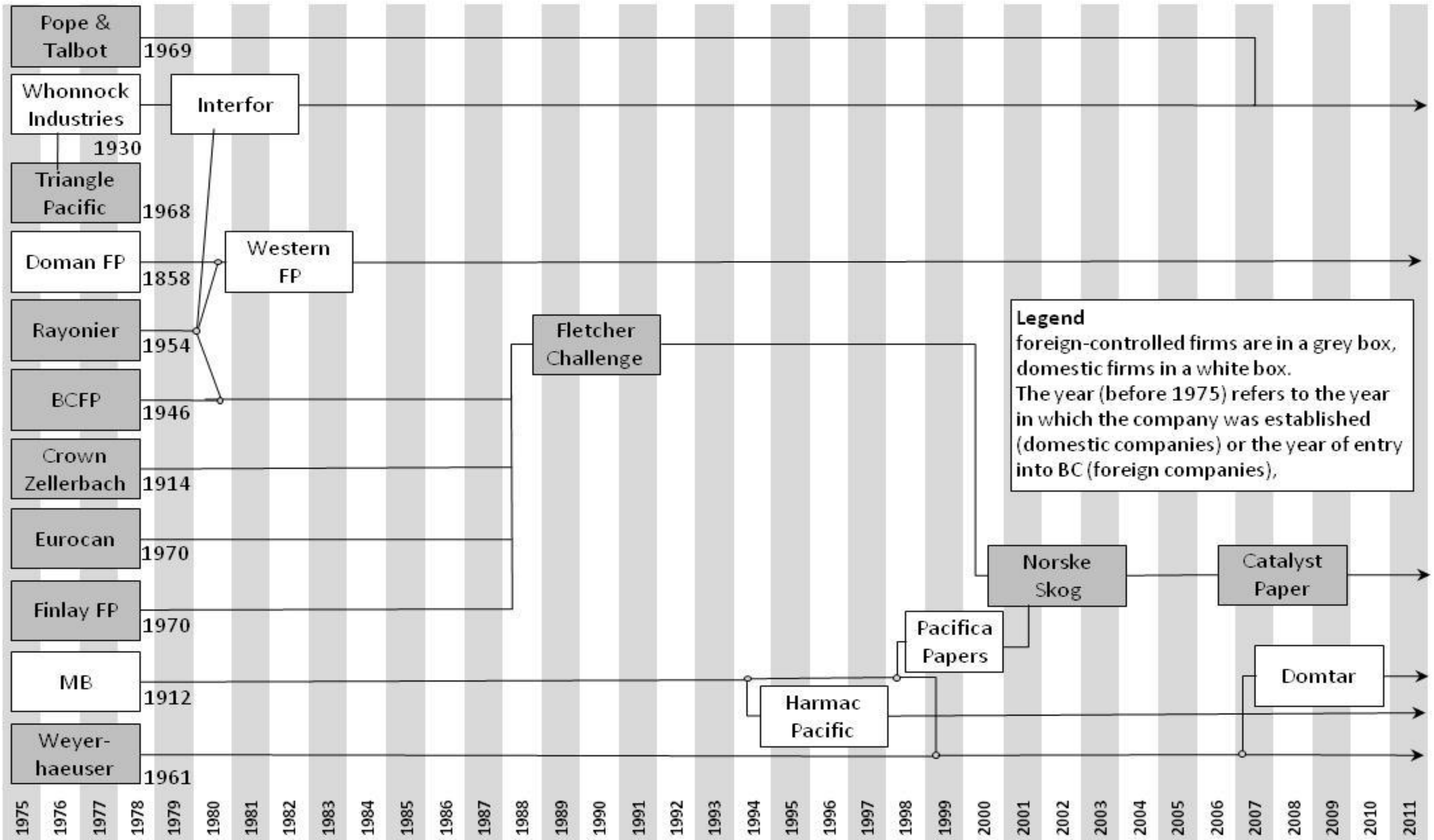
An overview about the major mergers and acquisitions since 1975 is displayed in figure 5.1. The twenty companies listed in 1975 have merged into only twelve until 2011, which reflects the overall downsizing of the industry that started during the 1980s recession. A combination of excessive entry and technological factors led to the massive exit of firms during the first half of the 1980s (Brunelle 1990, 116). The first shakeout occurred at the beginning of the recession, due to a weak US housing market and decreasing demand. This is reflected in the diagram by the takeover of Rayonier by Interfor, Doman, and British Columbia Forest Products (BCFP). In the same year, Doman formed Western Forest Products as a joint venture with two other forest companies. The second shakeout took place when demand recovered after the crisis, because supply increased even more, causing prices to drop to near-recession levels in 1986. Thus in 1988, BCFP, Crown Zellerbach, Eurocan, and Finlay were dismantled and partly acquired by the New Zealand-based corporation Fletcher Challenge. Interfor and Western FP emerged as large domestic companies.

A third wave of takeovers occurred in the early to mid 2000s, fed by the soaring US housing market, which provided funds for acquisitions and expansion. In 2004, West Fraser Timber took over Weldwood. In the same year, Tolko acquired a majority of Riverside and Canfor took over Slocan. Pope & Talbot was taken over by Interfor in 2007.

From the end 1980s on, large forest corporations started to de-integrate and spin off part of their business, particularly their paper operations, into separate companies or limited partnerships. In such ways, Howe Sound Pulp and Paper was spun off in 1988 from Canfor, Harmac was separated from MacMillan Bloedel in 1994, Pacifica Papers in 1998. Domtar acquired Weyerhaeuser's pulp mill in Kamloops in 2007.

Starting from the end 1980s, several foreign companies newly entered the province: the New Zealand based multinational Fletcher Challenge (1988), the US-based Louisiana Pacific (LP), specialized in OSB and engineered wood (1993) and the Norwegian pulp company Norske Skog (2000). As a major difference to the old, vertically integrated Fordist giants, such as Rayonier or Crown Zellerbach, the new entrants were specialized forest companies with a focused field of business. The success of those new entrants differed. Fletcher Challenge and Norske Skog withdrew from BC after a couple of years, while LP's mills are still operating at present. In general, the picture of M&A shows a withdrawal of foreign owned companies. In 2011, four out of twelve major companies were under foreign control, compared to ten out of twenty in 1975.

Figure 5.1 Major forest companies in BC, mergers & acquisitions 1975-2011



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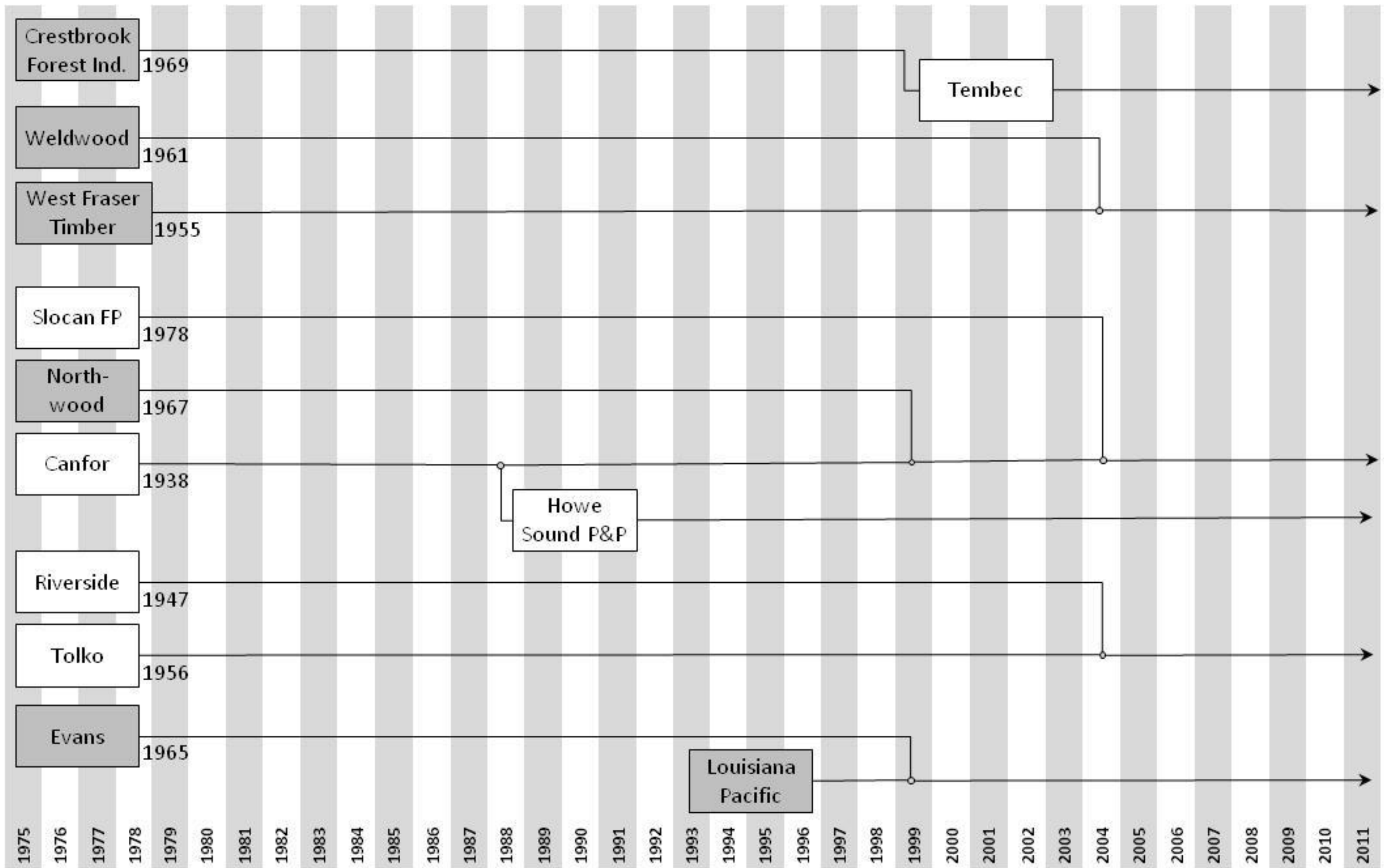


Source: author's graphical representation

Despite this turnover, the 1980s crisis did not have an immediate effect on the overall level of corporate concentration of timber holdings. Corporate concentration, measured by the share of AAC held by the largest firms, remained remarkably stable and even increased after 1975. In 1990/92 and 2000/01 the top ten firms controlled more than half of AAC (table 5.2). The share of AACs held by the top 10 companies peaked at 57% in 1999/2000 (BCMoF 2011, 126). Since then, it decreased due to government efforts targeted towards SME, such as the re-allocation of AAC and BCTS.

Table 5.2 Concentration of timber harvest allocation, selected years

	Share of AAC (%)			
Operator by rank	**1975**	**1990/91**	**2000/01**	**2006/07**
Top 1	9.4	11.3	11.4	10.9
Top 3	21.6	27.1	29.0	25.7
Top 5	29.6	37.1	40.4	33.6
Top 10	42.7	54.0	56.6	41.9
All others	57.3	46.0	43.4	58.1

Source: BCMoF (2007b)

5.3 The Case of Canfor

5.3.1 The Fordist Prelude

Canfor was started by the Bentley Brothers – their Anglicized name – who were Jewish refugees seeking to escape Hitler's Germany in the 1930s. They had a background in furniture manufacture and on arrival in BC decided to invest initially in a plywood operation. They expanded their business in World War 2 including by providing materials for the Mosquito fighter plane. Over the following decades, several sawmills and a shingle and shake mill in the Lower Mainland were acquired, along with logging operations in the Fraser Valley and on Vancouver Island; the company expanded into a fully integrated forest product corporation. Thus in 1951, a small unbleached kraft pulp mill in Port Mellon, on Howe Sound, was purchased. Subsequently, this mill was expanded and upgraded to produce bleached pulp. In 1955 Canfor began operations in Alberta with the acquisition of a plywood mill, several sawmills and the associated logging rights.

In the 1960s, the company expanded into BC's Northern Interior, acquiring several sawmills, planer mills, and timber harvest licenses in the Peace River District. As part of joint venture arrangements two pulp mills were constructed in Prince George: Intercontinental Pulp and Prince George Pulp and Paper and. Due to the substantial resources required, both projects were undertaken as joint ventures with European companies. In 1970, a new sawmill was built in Hines Creek, Alberta. In 1981, Canfor took over Swanson Lumber, taking possession of several sawmills and woodland operations in High Level, Alberta and Fort St. John, BC.

By the end of the 1970s, Canfor had grown into a fully vertically integrated forest company, employing about seven thousand people. The product range included dimension lumber, kraft pulp, Douglas fir plywood, Canadian Softwood Plywood, hardboards and shingles and shakes. In addition, Canfor owned the Building Material Division, selling lumber and building materials through of outlets in all regions of Canada and through its US subsidiary Chandler Corporation. Geographically, by 1970 Canfor owned assets in the Coastal and Northern Interior regions of BC and in northern Alberta. The portfolio included three pulp mills, one on Howe Sound, two (joint ventures) in Prince George, a shingle and shake mill in Vancouver, plywood mills in Kamloops, Grande Prairie (Alberta) and New Westminster and a panel plant in New Westminster. Canfor operated sawmills in the Northern Interior, in the Lower Mainland, in the Thompson River region and in northern Alberta. Sales offices existed in Vancouver, Montreal, London, Brussels and Tokyo. In 1980, corporate sales were $730 million, about 1/3 the size of its biggest competitor in BC, MacMillan Bloedel. Quite unusual among the leading Fordist corporations Canfor remained a private company, a situation that was about to change.

5.3.2 Canfor's Evolution since the 1980s Recessionary Crisis: Overview

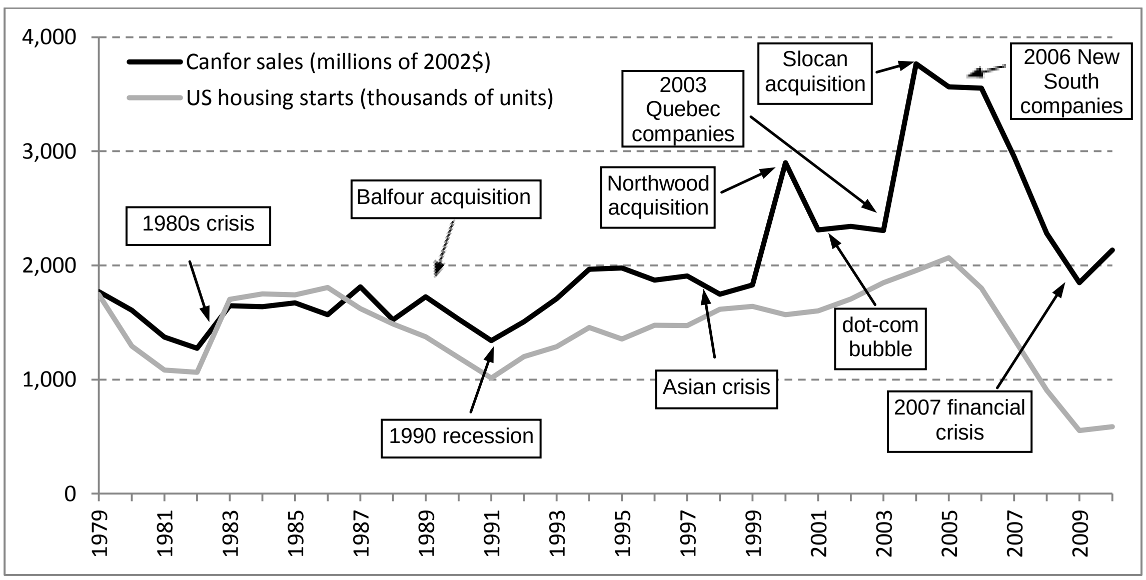
Like all BC forest companies, Canfor was severely affected by the 1980s recession. However, in contrast to the other leading Fordist dominants, especially MB, Crown Zellerbach Canada, British Columbia Forest Products, Weldwood, and Rayonier, it has survived and expanded, albeit not without ongoing problems. As a key change, the company went public in 1983 for the main reason to access funding.

Canfor's trajectory since 1979 is illustrated by corporate sales (figure 5.2), production (figure 5.3), and other industrial key variables (table 5.3). Sales earnings, and return to capital are volatile through booms and busts that are mainly driven by export demand. The series reflect three broad restructuring strategies. Rationalization is targeted towards cost cutting, such as through mill closures or the abandonment of unproductive business lines. Canfor continuously modernized and upgraded all of its sawmills and pulp mills, to ensure low operation costs and maximum efficiency. In such ways, rationalization resulted in the downsizing of Canfor's workforce by more than half from 1982 to 2010 while sales more than tripled during this period.

Consolidation includes capacity expansion in existing mills and acquisitions of competitors. Since the late 1980s, after the crisis, sales are subject to an increasing trend. This was mainly achieved through the takeover of large competitors whereas the construction of new mills plays a minor role. Only two mills were newly built since 1980: the Hines Creek sawmill (completed in 1995, replacing the old mill at the same site) and the Peace Valley OSB plant (2005).

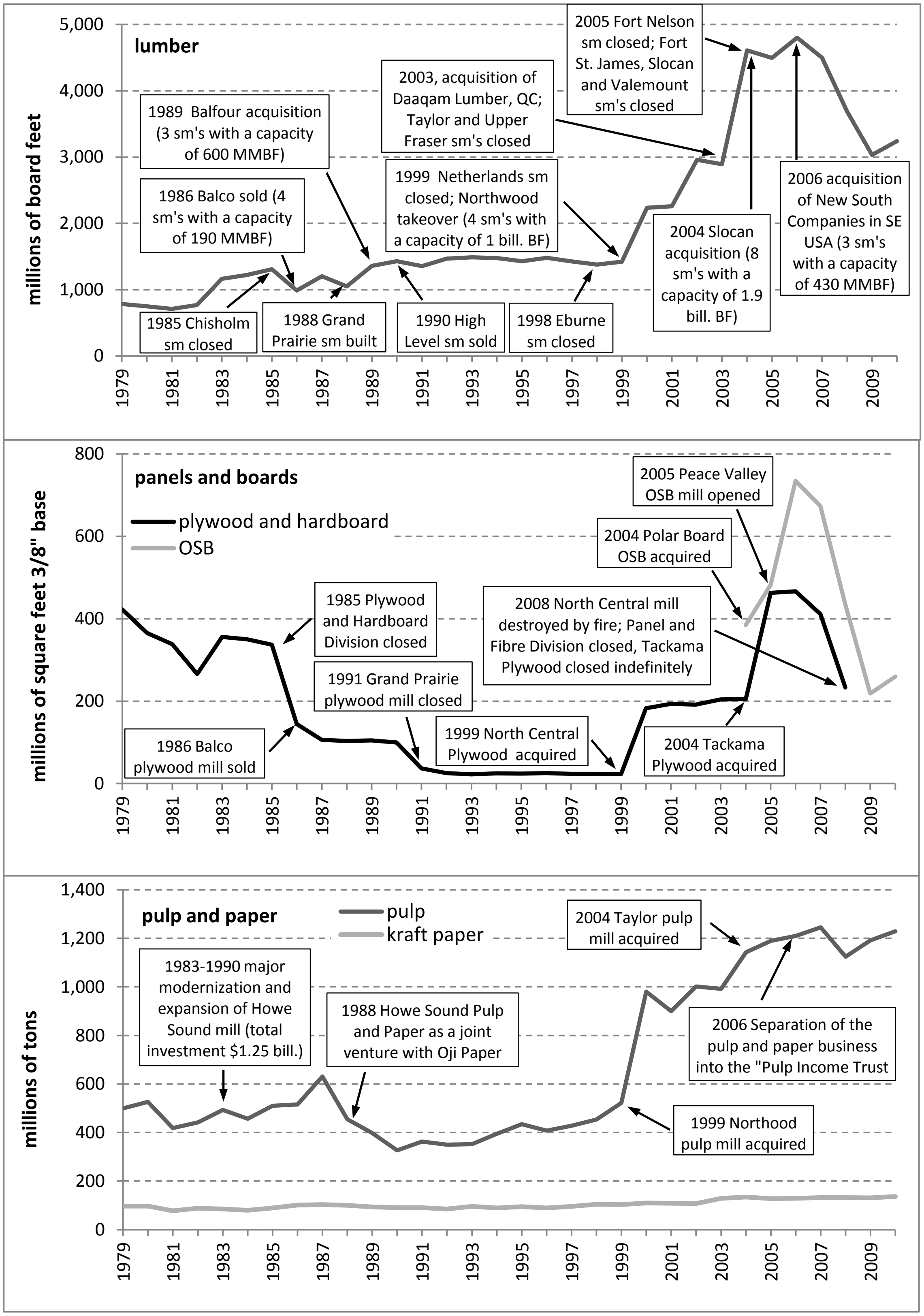
Finally, geographic diversification was achieved through expansion out of Western Canada into Quebec (2003) and the South-Eastern US (2006).

Figure 5.2 Canfor Corporation, sales 1979-2010



Data: Canfor annual reports

Figure 5.3 Canfor Corporation, production 1979-2010



Data: Canfor annual reports

Table 5.3 Canfor Corporation, selected aggregate trends 1979-2010

Year	Sales (million $)	Employment	Net earnings (million $)	Capital investment (million $)	ROCE
1979	734	N/A	75	48	18.7%
1980	730	N/A	47	49	11.2%
1981	711	N/A	2	85	3.0%
1982	730	7,122	-87	102	-7.8%
1983	995	7,226	-46	23	-2.5%
1984	1,030	7,230	-27	41	-0.1%
1985	1,084	6,260	-68	64	-5.5%
1986	1,047	5,293	17	38	5.5%
1987	1,245	5,099	97	58	16.3%
1988	1,084	4,393	174	108	24.2%
1989	1,283	4,817	96	306	11.1%
1990	1,198	4,530	4	428	1.4%
1991	1,109	4,317	-94	144	-5.0%
1992	1,276	4,252	-50	59	-1.1%
1993	1,500	4,234	41	118	4.8%
1994	1,759	4,345	125	110	11.6%
1995	1,811	4,400	46	70	5.5%
1996	1,729	4,400	-57	65	-0.8%
1997	1,776	4,300	-33	70	0.3%
1998	1,632	3,850	-204	48	-10.9%
1999	1,725	5,800	103	120	12.3%
2000	2,788	5,760	126	122	9.3%
2001	2,258	5,850	22	42	3.5%
2002	2,343	5,600	6	56	2.7%
2003	2,355	5,525	147	114	10.3%
2004	3,925	8,100	416	203	19.8%
2005	3,788	7,000	96	335	4.9%
2006	3,842	7,300	493	107	17.4%
2007	3,249	4,726	-295	91	-17.0%
2008	2,560	4,053	-321	80	-17.2%
2009	2,076	3,380	-63	59	-3.1%
2010	2,430	3,370	161	128	5.5%

Data: Canfor annual reports

Over time, Canfor's strategies of rationalization and consolidation resulted in a considerable turnover of its factories (table 5.4). While lumber and pulp capacity steadily expanded, many mills were sold or closed. The remaining mills were continuously updated and expanded to take advantage of economies of scale and ensure low average cost.

Table 5.4 Canfor Corporation, capacity of major operations 1983-2005

Sawmills				
Division	**Capacity (MMBF)**			
	1983	**1990**	**2000**	**2005**
British Columbia				
Chetwynd	122	150	180	240
Clear Lake (Prince George)	-	110	135	150
Eburne (Vancouver)	140	115	closed	
Fort St. James	168	215	232	sold
Fort St. John	103	140	174	300
Houston	-	-	430	600
Isle Pierre	60	115	171	262
Kamloops	69	sold		
Louis Creek	83	sold		
Mackenzie	-	-	-	502
Merritt	72	sold		
Netherlands Sawmill (Prince George)	-	235	closed	
Polar (Bear Lake)	-	115	158	263
Prince George Sawmill	-	-	216	350
Quesnel	-	-	-	400
Radium Hot Springs	-	-	-	170
Rustad (Prince George)	-	-	237	375
Taylor	-	75	76	closed
Upper Fraser	-	-	268	closed
Valemount	-	-	-	81
Vavenby	-	-	-	253
Westcoast Cellufibre (Vancouver)[1]	30	45	operating	operating
Alberta				
Chisholm	14	closed		
Grand Prairie	110	155	199	240
High Level	168	sold		
Hines Creek	55	65	82	closed

[1] Part of Howe Sound Pulp and Paper since 1988
(continued on next page)

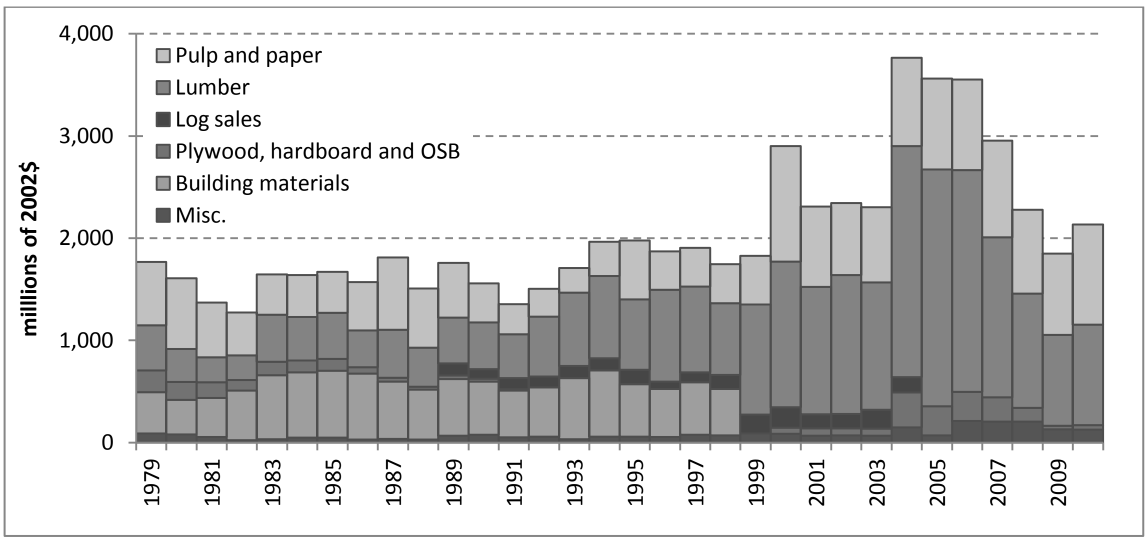
Board mills					
Division	Product	Capacity (millions of square feet 3/8" base)			
		1983	1990	2000	2005
Balco (Kamloops, BC)	plywood	113	sold		
Polar Board (Fort Nelson, BC	OSB	-	-	-	570
Grand Prairie, AL	plywood	62	closed		
North Central Plywood (Prince George, BC)	plywood	-	-	167	190
Panel and Fibre (New Westminster, BC)	hardboard	-	40	-	closed
Plywood and Hardboard (New Westminster, BC)	plywood	134	closed		
	hardboard	65	closed		
Tackama (Fort Nelson, BC)	plywood	-	-	-	273
Pulp and paper mills					
Division	**Product**	**Capacity (thousands of tons)**			
		1983	**1990**	**2000**	**2005**
Howe Sound Pulp and Paper (Port Mellon, BC)	pulp	180	345	340	398
	newsprint	-	200	210	207
Intercontinental Pulp (Prince George, BC)	pulp	219	235	297.5	309
Northwood pulp mill (Prince George, BC)	pulp	-	-	553	550
Prince George Pulp and Paper (Prince George, BC)	pulp	153	170	160	137
	sack kraft paper	102	100	120	142
Taylor, BC	pulp	-	-	-	220
Total capacity					
Product		**1983**	**1990**	**2000**	**2005**
Lumber (MMBF)		1,198	1,535	2,816	5,371
Panels and boards (mill. of square ft. 3/8" base)		374	40	167	933
Pulp (000 tons)		552	750	1,351	1,614

Data: Canfor annual reports

Sales by product (figure 5.4) reflect the shift from an integrated forest company to a specialized cost leader. Several business lines were abandoned, such as plywood and hardboard (1991) and the building material sales business (1998). OSB production started in 2004. From 2000, Canfor decided to focus its business on wood products, which the company considers its core business. By the time, wood products comprised more than half of total sales, but that share decreased after the 2007 recession as the pulp market was less affected by the crisis and recovered quicker. The same was true for pulp sales during the 1980s recession, whereas the early 1990s recession strongly affected the pulp market and to a lesser extent the lumber market (Hayter 2004a, 55). In such ways, the diversification provided by keeping both business lines might be justified, as it seems to decrease a company's exposure to recession.

Canfor's policy regarding their pulp and paper business seems somewhat inconsistent. While Howe Sound Pulp and Paper was separated into an independent company as early as 1988, Canfor held on to its remaining pulp mills at that time. However, in 2006, the pulp and paper production was separated from the main business line into a limited partnership "*to concentrate […] efforts on offering quality wood products and reliable service to […] customers*" (Canfor Corporation 2006, 3). Even so, Canfor still owned 50.2 of the shares of the limited partnership in 2010, de-facto keeping control of the business. Possibly, the true motive for the separation might have less to do with operating efficiency than be avoiding corporate taxes, as an income trust can be used as a tool to considerably reduce a company's taxable income (see Jog and Wang 2004, 855).

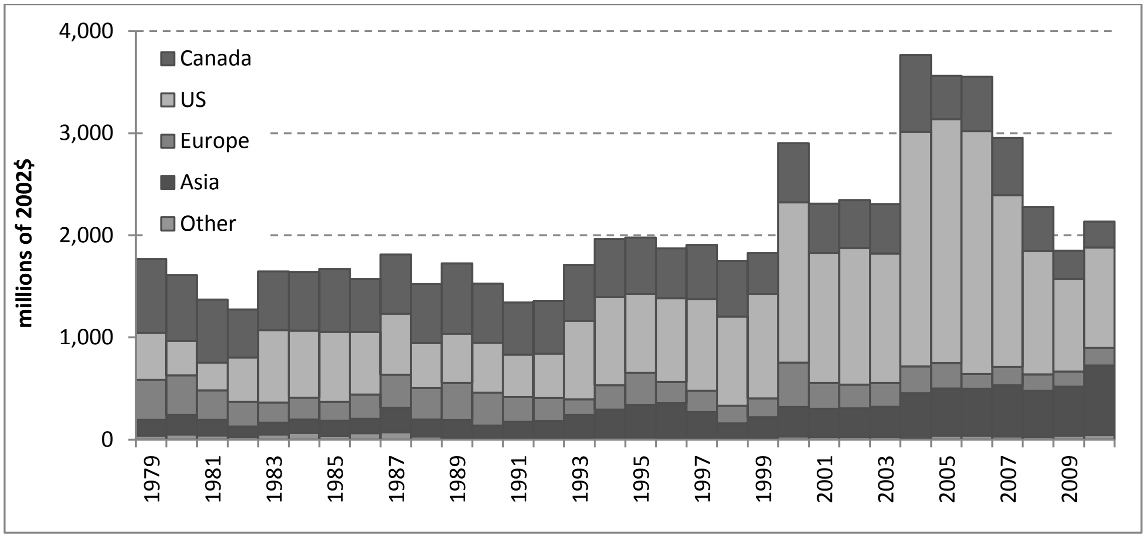
Figure 5.4 Canfor Corporation, sales by product 1979-2010



Data: Canfor Corporation, annual reports

The destinations of sales (figure 5.5) are in line with aggregate findings for the industry. From the early 1990s on, the US became the most important export market, peaking at a share as high as 2/3 in 2005 and 2006. After the 2007 crisis, sales to the US started to decrease. Asian exports peak in 1996, which reflects the growing importance of the Japanese market until the Asian Crisis. Canfor's increasing engagement in China, such as the opening of sales offices in Hong Kong (1989) and Shanghai (2005), is reflected by increasing exports to Asia during the 2000s.

Figure 5.5 Canfor Corporation, sales by destination 1979-2010



Data: Canfor Corporation, annual reports

After 1980, Canfor's restructuring can be classified into three periods. The time from 1980-88 is dominated by rationalization in order to cope with the effects of the 1980s crisis. Although rationalization continues during the 1989-1998 period, the corporate focus is shifting towards expansion through acquisitions. The period since 1999 is characterized by expansion and geographic diversification, while rationalization remains an underlying factor. In the following, Canfor's restructuring strategy during these three periods is investigated in more detail. In general, Canfor's strategies reveal how at least one dinosaur was able to survive, albeit with a changed corporate structure.

5.3.3 Rationalization with Consolidation 1980-88

The 1980s crisis led to a downturn of the US housing marked and tumbling prices for lumber and pulp in combination with a strong Canadian dollar. From 1982 to 1985, Canfor experienced four subsequent years of loss. In July 1983, the company went public, issuing 6.5 million shares that provided net proceeds of $133 million.

In response to the crisis, Canfor took a series of measures to consolidate, cut cost and increase productivity (table 5.5, figure 5.6). From 1982 to 1986, employment was reduced by 25%. Canfor sold all of its shares of Balco Forest Products to Tolko in order to reduce debt; that included three sawmills and a panel mill in the Thompson Nicola Region. The unprofitable plywood mill in New Westminster was closed.

In addition, Canfor undertook a series of investment projects in order to increase the production of higher value products. Production of sack kraft paper started at Prince George Pulp and Paper. Higher value lumber products were introduced, such as structural grades for the Japanese market, finger jointed studs, panels, sidings, and clear flitches. Consequently, output capacity in 1985 increased by 17% in wood products and by 21% in pulp and paper, as compared to 1984. In 1986, the company returned to positive profits, a boom that lasted for five years. Pulp and lumber production reached a record high and net income peaked in 1988 at $174 million, due to better markets for pulp and lumber and because of consolidation and cost cutting. In 1986, a severe strike affected most BC wood and paper operations, causing an estimated cost of $30 million.

A number of policy changes took place from the end of the 1980s. A 15% charge on lumber exports to the US was introduced. Stumpage rates were increased and forest companies had to bear all cost for road building and silviculture. In addition, 5% of long-term tenures were allocated to the Small Business Program. Concerns about those institutional shifts, especially forest policy, and the trade conflict (in connection with a strong Canadian dollar) are expressed in the reports, although they did not affect the company's profits yet as they occurred in times of strong markets and record earnings. The annual reports during the 1980s refer neither to Aboriginal conflicts nor to major conflicts with environmental groups, although Canfor seems to respond to increasing environmental awareness. In such ways, environmental topics appear from 1985 ("*reforestation: our commitment to the future*") and from 1988, a regular section "*Canfor and the environment*" is included in the reports, in which the company emphasizes its commitment to be a "*leader in environmental protection*" (Canfor Corporation 1988, 19).

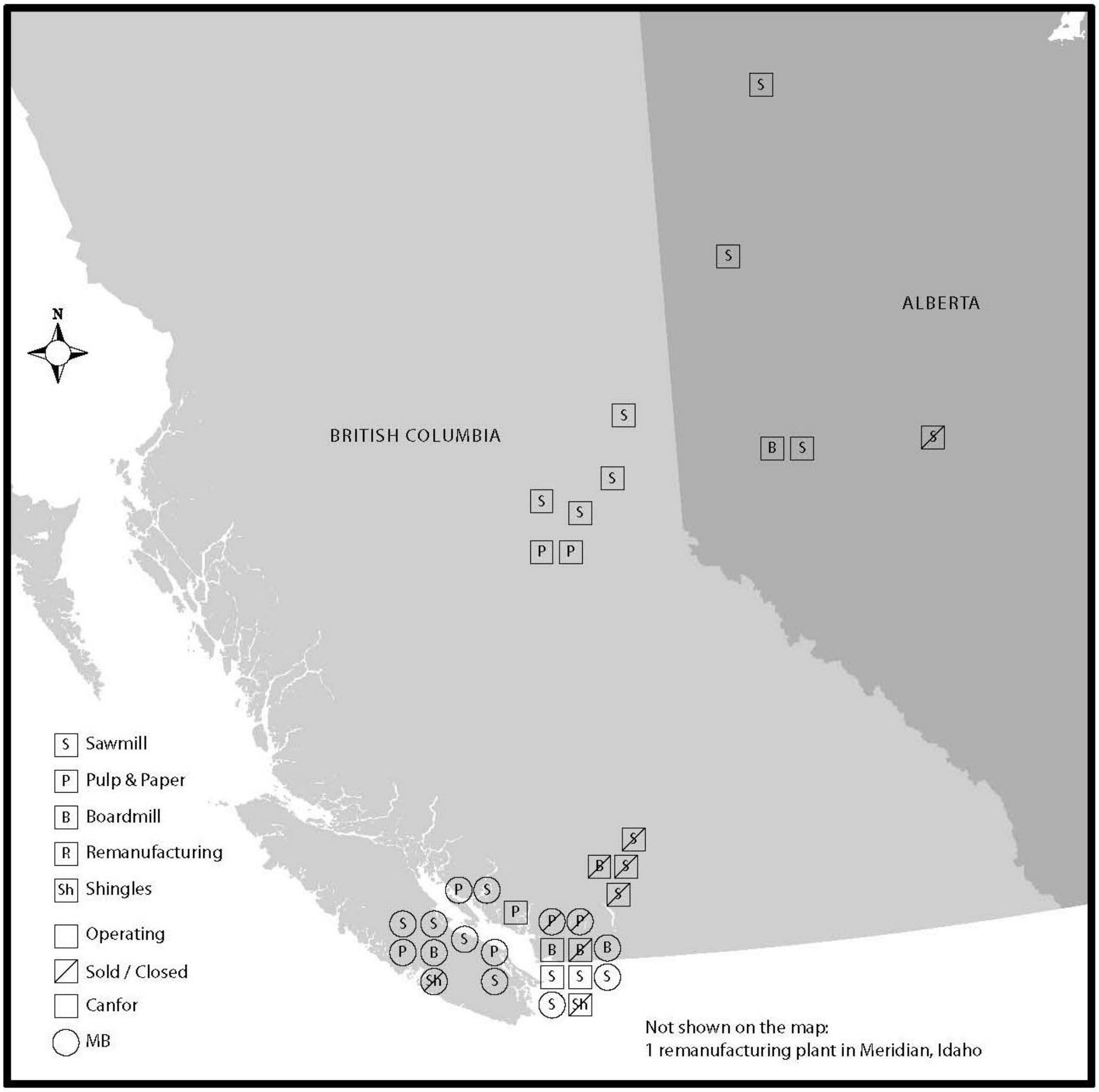
Consolidation continued during the boom years that followed the crisis, in combination with investment to upgrade sawmills and pulp mills. In 1988, Canfor formed Howe Sound Pulp and Paper, a joint enterprise owned 50:50 by Canfor and a Japanese corporation. A total of $1.25 billion was invested to build a pulp and newsprint complex at the existing Port Mellon mill site.

Table 5.5 Major changes in Canfor's corporate system 1980-88

Rationalization through mill sales and closures	
1985	Closure of Chisholm sawmill; closure of New Westminster Plywood and Hardboard Division
1986	Sale of Balco Forest Products to Tolko (1 plywood mill in Kamloops, 3 sawmills in Kamloops, Louis Creek and Merritt)
1988	Closure of Huntting-Merritt Shingle Division in Vancouver
Organizational change	
1983	Canfor becomes a public company, issuing 6.5 million shares that provide net proceeds of $133 million
1988	Howe Sound Pulp and Paper Joint Venture in partnership with Oji Papers
Major capital investment	
1983	Eburne Sawmill modernization completed ($30 million investment from 1977-83)
1985	New pulp machine at Howe Sound Pulp mill ($34.8 mill.)
1987	Trimmer optimization at Fort St. John sawmill
1988	Fort St. James sawmill upgrade. Shift to the production of dimension lumber for offshore markets ($10 million); replacement of equipment at Chetwynd sawmill ($18 million); construction of a new dimension lumber mill in Grande Prairie, AL (38 million); upgrade of Prince George Pulp and Paper. Introduction of computerized control systems ($47 million); major upgrade and expansion of the Howe Sound Pulp mill ($1.25 billion total investment from 1998-92);

Data: Canfor annual reports.

Figure 5.6 Canfor Corporation, major operations 1980-1988



Source: Canfor annual reports; Hayter (1976)

5.3.4 Consolidation and Rationalization 1989-97

In 1989, Canfor acquired Balfour Forest Products for $94 million; four sawmills in the Northern Interior with a total capacity of 600 million board feet plus an overseas marketing operation. This action marks a change in corporate strategy. Canfor started to restructure towards flexible mass production, characterized by expansion, capacity increase, rationalization, and organizational restructuring (table 5.6). In the same year, the company purchased a remanufacturing plant in Washington. A sales office in Hong Kong was opened, primarily focused to promote pulp sales on the Asian market.

Furthermore, Canfor established a R&D Centre in Vancouver with a budget of approximately $5 million per year.

During the 1990s, markets for pulp and lumber were weak, low profitability and rates of return became an issue. In addition, *"[t]he forest industry in Canada and particularly in British Columbia is facing tremendous public and regulatory pressure with respect to the environment*" (Canfor Corporation 1991, 22). In 1992, the senior management team was replaced and Arild Nielssen became president and CEO. Subsequently, the "Doing it Better" initiative was launched, in order to improve product quality, productivity and work safety. The initiative relied on seven cross-functional teams for working capital, fibre cost, operational efficiency and product and service differentiation.

Canfor continued its consolidation strategy of the 80s crisis; unprofitable mills and product lines were either sold or closed, while the remaining mills were continuously upgraded and modernized. Employment was reduced by 15% between 1990 and 1998. Corporate logging crews were to an increasing extent replaced by contract harvesting, which reflects an industry-wide trend (see Forest Renewal BC 1998). Capital investment peaked during 1989 and 1990 due to the major expansion and modernization of Howe Sound Pulp and Paper; the mill started to produce newsprint in 1991. In addition, the Intercontinental mill was modernized and production of bleached kraft paper started at Prince George Pulp and Paper. Canfor increased its sawmilling capacity through modernization and the construction of a new sawmill in Hines Creek, Alberta. In 1994, the attempt to acquire Slocan Forest Products failed. That acquisition would have increased Canfor's capacity considerably.

In addition to cost reduction, Canfor took effort to increase the sale of value added products. Two new engineered wood products were developed in the 1990: Machine stress rated (MSR) lumber and manufactured wall components. Over the following years, several new products were introduced, such as I-joist flanges, and a branded lumber program started. In addition, Canfor opened its first plant for wood fibre composite mat products.

In 1996, the need for "*adapting to change*" (Canfor Corporation 1996, 7) was recognized. Canfor experienced a net loss of $56 million and had to respond to a bundle of sudden and unexpected institutional changes, including high stumpage rates, changing government policy, trade quotas, Aboriginal land claims and environmental issues.

In 1997, the Japanese market collapsed due to the Asian crisis. Canfor experienced a net loss of $33 million. A major restructuring program started, focused on "*shareholder value*", to respond to the changed business environment. The main reasons for restructuring, as stated in the annual reports, are high costs, low returns to capital and falling stock prices. The major institutional factor affecting the company is the trade conflict with the US, while the War in the Woods had no immediate consequences for the company. ENGOs are mentioned in the reports from the late 1980s on as possible threats for business. "*The forest industry in general is becoming increasingly subject to the pressures of the growing environmental awareness felt throughout the industrialized world. These pressures affect operations and […] there is considerable uncertainty regarding new environmental standards that may arise and the costs of meeting these new standards*" (Canfor Corporation 1989, 28). In similar ways, the reports refer to Aboriginal land claims. "*Native land claims in Canada present a significant risk and uncertainty to the security of supply of timber in the forest industry*" (Canfor Corporation 1990, 29). However, Canfor was never confronted with direct actions, such as the blockade of logging operations, international marketing campaigns, not to mention tree spiking or sabotage.

In reaction to the 1990s crisis, several operations were shut down. Canfor began to shift its assets away from the Coast into the Northern Interior where pressure from ENGOs and Aboriginal groups was considerably lower. In 1998, David Emerson was made CEO; he orchestrated the new regional organization of the company. Three business segments were formed, which were managed as quasi-independent units with their own financial accountability. The Coastal Wood Products Group was in charge of the Coastal logging operations, which secured the fibre supply for the Howe Sound Pulp and Paper mill and the Panel and Fibre Division in New Westminster. By 1998, all other Coastal operations had been closed. The Northern Wood Products Group included ten sawmills in central and northern BC and northern Alberta with an annual production of approximately 1.4 billion board feet and several remanufacturing plants with finger-jointing and laminating facilities. The Pulp and Paper Group included Prince George Pulp and Paper and Intercontinental Pulp, both located in Prince George, producing northern softwood kraft pulp and kraft paper. In addition, Canfor owned 50% of Howe

Sound P&P, which produced northern softwood kraft pulp and newsprint, mainly for the Japanese market.

Canfor's main goal of restructuring was to become cost leader in the main business lines – pulp and dimension lumber – pursuing a strategy of low cost, high volume and high efficiency. Northwood, another big BC-based forest company, was acquired in 1999. The newly gained assets included a pulp mill, a plywood mill and a remanufacturing plant in Prince George along with four sawmills in the Northern Interior. That takeover doubled the annual pulp capacity to more than a million tons and increased softwood lumber production by one billion board feet, which made Canfor Canada's largest softwood lumber producer. Synergies between both companies led to substantial cost reduction. Subsequently, the Netherlands Division, a sawmill with associated timber tenure, was closed and its fibre supply directed to other sawmills in the area, such as the Polar Division, where a third shift was introduced. $49 million were invested in sawmill upgrades.

By the end of the 1990s, Canfor had reached cost leadership in pulp and dimension lumber. In addition, a number of value added products for niche markets were produced, such as specialty kraft papers and remanufactured lumber. The company strongly committed to efficiency and innovation. Unprofitable business lines had been abandoned, such as shingles and shakes, plywood, and hardboard.

Table 5.6 Major changes in Canfor's corporate system 1989-98

Capacity increase through major acquisitions in Western Canada	
1989	Balfour acquired for $150 million; 4 sawmills in Bear Lake, Clear Lake, Prince George and Taylor (600 MMBF annual capacity)
Rationalization through mill sales and closures	
1990	High Level sawmill in Alberta sold to Daishowa Canada for $18.8 million
1991	Plywood mill in Grand Prairie, AL, closed due to competition from new products, such as OSB and poor financial prospects
1997	Specialty Products Division in Vancouver closed. The equipment is transferred to the Clear Lake and Netherland sawmills in the Prince George area
1998	Eburne sawmill in Vancouver closed (not profitable, fibre supply problems)
	Remanufacturing plant in Meridian, Idaho is sold (not part of the core business)
Major capital investment	
1989	Upgrade of the Prince George sodium chlorate plant (jointly used by Intercontinental Pulp and PGPP ($60 million); Capacity for kiln-dried lumber is increased at the Eburne sawmill ($23 million)
1991	Upgrade of the recovery boiler at Intercontinental Pulp ($51 million until 1993)
1994	Upgrade of 5 sawmills for $35 million (increased lumber yield, improved product mix, cost reductions); installation of oxygen delignification system at Intercontinental Pulp ($13 million); gate roll size press section in newsprint machine at HSPP ($32 million)

Source: Canfor annual reports

5.3.5 Expansion, Geographic Diversification and Rationalization 1998-2010

Markets recovered during the early and mid 2000s, providing record earnings for Canfor. That supported the belief widely held within the company that every bust is followed by a new and even stronger boom: "*History shows that every once in a while, the market experiences a downturn. But, history also shows that the market has always demonstrated the resiliency to rebound. Well beyond previous levels in fact*" (Canfor Corporation 2001, 1). However, the boom of the early and mid 2000s was followed by an unprecedented recession with the highest losses ever experienced.

The Northwood takeover had doubled Canfor's pulp production and significantly increased lumber capacity. In combination with strong markets and high prices, this resulted in record earnings of $126 million in 2000. Canfor produced 1.3 million tons of pulp, 198,000 tons of newsprint and 110,000 tons of kraft paper, including high performance specialty papers.

From 1998-2002 $635 million were spent for acquisitions, $405 million in capital investment and $20 million for R&D (table 5.7 and figure 5.7). Several sawmills in the Central Interior were upgraded and modernized to use the vast uplift of pine beetle infested wood in the area. Houston was expanded to an annual capacity of more than 600 million board feet, which made it the largest sawmill in the world. David Emerson, Canfor's President and CEO, stated that *"[t]hese mills are part of our future in British Columbia*[16]*" and* that *"[t]his investment reflects Canfor's focus on high return capital projects that fit our overall strategy to enhance the productivity of our mills and lower our conversion costs. […] By ensuring that our mills are among the most efficient in the world, Canfor is in a position to run our operations continually and serve our customers consistently. This, in turn, creates stability for contractors, suppliers, workers and the community tax base."*[17]

In order to reduce costs and rationalize, third shifts were introduced in a number of sawmills to take advantage of economies of scale, *"[m]aximizing capital utilization and efficiency*" (Canfor Corporation 2002, 7). In 2003, lumber production reached a record of three billion BF. In the same year, Canfor started to expand out of Western Canada. A sawmill and a logging operation in Quebec were purchased, adding 150 million BF annual capacity. In addition to its main product lines, low cost pulp and dimension lumber, Canfor manufactured value added products for niche markets, such as high performance kraft papers and specialty wood products.

In 2004, Canfor successfully took over Slocan Forest Products. The newly acquired assets included a pulp mill in Taylor, a plywood mill and an OSB mill in Fort Nelson, a remanufacturing plant in Chilliwack and ten sawmills, most of them located in the Northern Interior. That takeover increased annual lumber capacity to 5.2 billion BF, making Canfor the third largest forest company in Canada and the 29th largest in the world (PWC 2007). After the takeover, synergies between the two companies led to a reduction of 1,100 employees, decreased production cost, and increased productivity. Subsequently Canfor sold three lumber operations and two sawmills in Valemount and Slocan due to high costs. In addition, the Competition Bureau required the sale of the Fort St. James sawmill and related tenures after the Slocan acquisition in order to prevent Canfor from gaining too much market control in the Prince George region, which would have threatened the competition for logs.

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[16] The Globe and Mail (Canada), February 10, 2004

[17] Sawmill and bandmill blog, Monday, July 12, 2004; http://www.builditplans.com/Blog/2004/07/canfor-unveils-worlds-largest-sawmill.html (retrieved December 14, 2011)

Investment peaked in 2005, due to the construction of an OSB plant in Fort St. John. In addition, several sawmills were modernized and rebuilt and the Polar OSB mill upgraded. In the same year, Canfor abandoned all Coastal operations due to high costs and weak markets. This decision was not targeted towards short-term cost cutting but reflects the company's long-term strategy of geographical diversification.

In such ways, although the US market was still booming, Canfor sought to diversify its markets and increased its engagement in Asia. A new marketing office was opened in Shanghai and the company initiated cooperation with Chinese educational institutions to establish a vocational program for wood building practices. Furthermore, the JadeStar lumber brand was developed for the Japanese market. An International Distribution Centre was constructed in Richmond, BC, intended to serve the Asia-Pacific market.

In 2006, Canfor acquired the New South companies, located in North and South Carolina, for $182 million: three sawmills, two treating plants, a finger joint plant and a European lumber import business. In the same year, the decision was made to focus on the wood product business. All pulp and paper business was separated from the wood products business first into an indirectly owned limited partnership and later into an own company, the "Pulp Income Trust".

The trade conflict between Canada and the US took severe toll on Canfor's earnings. In 2001 *"[n]ot only did Canfor expend $7.2 million on legal and other costs, the dispute also cost Canfor thousands of hours of management time to deal with investigations, complete questionnaires and the verification processes […] Canfor's results were negatively impacted by recording a provision of $45.7 million for countervailing and anti-dumping duties levied by the U.S. Department of Commerce. Had the duties not been levied, Canfor's earnings would have been $0.67 per common share, instead of the reported $0.27 per share in 2001*" (Canfor Corporation 2001, 31). In 2002 a duty of 25% was imposed on softwood lumber exports to the US, leading to a cost $105 in cash duties and $9 million for related legal fees (Canfor Corporation 2002, 28), reducing net profit to just $6 million. Despite the duty, a soaring US housing market provided net earnings of $147 million in 2003 and even $416 million in 2004. In 2006, Canfor received $717 million in SLA duty refund.

The Forest Revitalization Plan of 2003 brought significant changes to forest policy and to the existing allocation of Crown timber tenures to licensees. The main components of the plan were a 20% take-back of forest tenures from major forest licensees, the establishment of a new timber pricing system and the elimination of constraints such as minimum cut controls, penalties for mill closures, consent requirements for tenure transfers, the subdivision of forest tenures and appurtenancy.

Canfor took several measures to anticipate criticism by ENGOs or Aboriginal groups. The company emphasized its "*commitment to cooperation with the native community*" (Canfor Corporation 2000, 5), which led to several joint ventures with Aboriginal bands. Likewise, the company became a member of the Coast Forest Conservation Initiative (CFCI) when it was initiated in 1999. CFCI was a collaboration of five BC-based forest companies seeking dialogue with ENGOs about sustainable development, conservation of Coastal forests and the future of the forest industry. In addition, several "green energy" projects were launched to save costs and respond to environmental concerns.

From the early 2000s on Canfor took efforts to retain the certification of its operations according to the standards required by the International Organization for Standardization (ISO) and by the Canadian Standards Association (CSA). In 2002, 73% of Canfor's harvest volume was certified according to the Sustainable Forest Management (SFM) criteria of CSA; in 2004, 91% of harvest reached SFM standards.

In 2007, the global financial crisis hit. Canfor suffered a devastating loss of $360 million, compared to record earnings of $470 million in the previous year. In connection with tumbling share prices, this led to a major conflict among the board of directors about the company's future between Jimmy Pattison, Canfor's largest shareholder (who controlled 25% of the shares) and Stephen Jarislowsky (who controlled 18%). As a consequence of this power-struggle, Jim Shepherd resigned as CEO and was replaced by Jim Shepard[18] (Van der Klippe 2007). Shepard decided to drive a radical cost-cutting strategy. Employment was reduced by 35%, from 7,300 in 2006 to 4,700 in 2007. Head office payroll cost was reduced by 25%. CEO compensation decreased by 25% and the directors' fees by 33%. The Panel and Fibre operation in New Westminster was closed permanently.

Further losses in the following year led to the indefinite closure of several mills. Curtails continued in 2009. Markets remained weak while the Canadian dollar was

[18] This is not a typo; the two names are indeed very similar.

strong; in addition, low timber prices resulted in a 15% soft wood lumber export tax. Canfor operated at 60% capacity. Shifts and work weeks were reduced, sawmills and panel mills idled. In order to compensate for the losses on the US market, Canfor increased its engagement on the Chinese market, shipments to China doubled compared to 2008. In 2010, exports to China accounted for 17% of total sales, overtaking Japan as largest offshore market. As lumber markets remained weak, Canfor's sawmills kept operating at 2/3 of capacity. However, high global demand for pulp, mainly driven by China, in connection with reduced supply due to the Chile earthquake led to record pulp prices and to earnings of $160 million in 2010, which ended the crisis for Canfor, at least for the present.

Table 5.7 Major changes in Canfor's corporate system 1999-2010

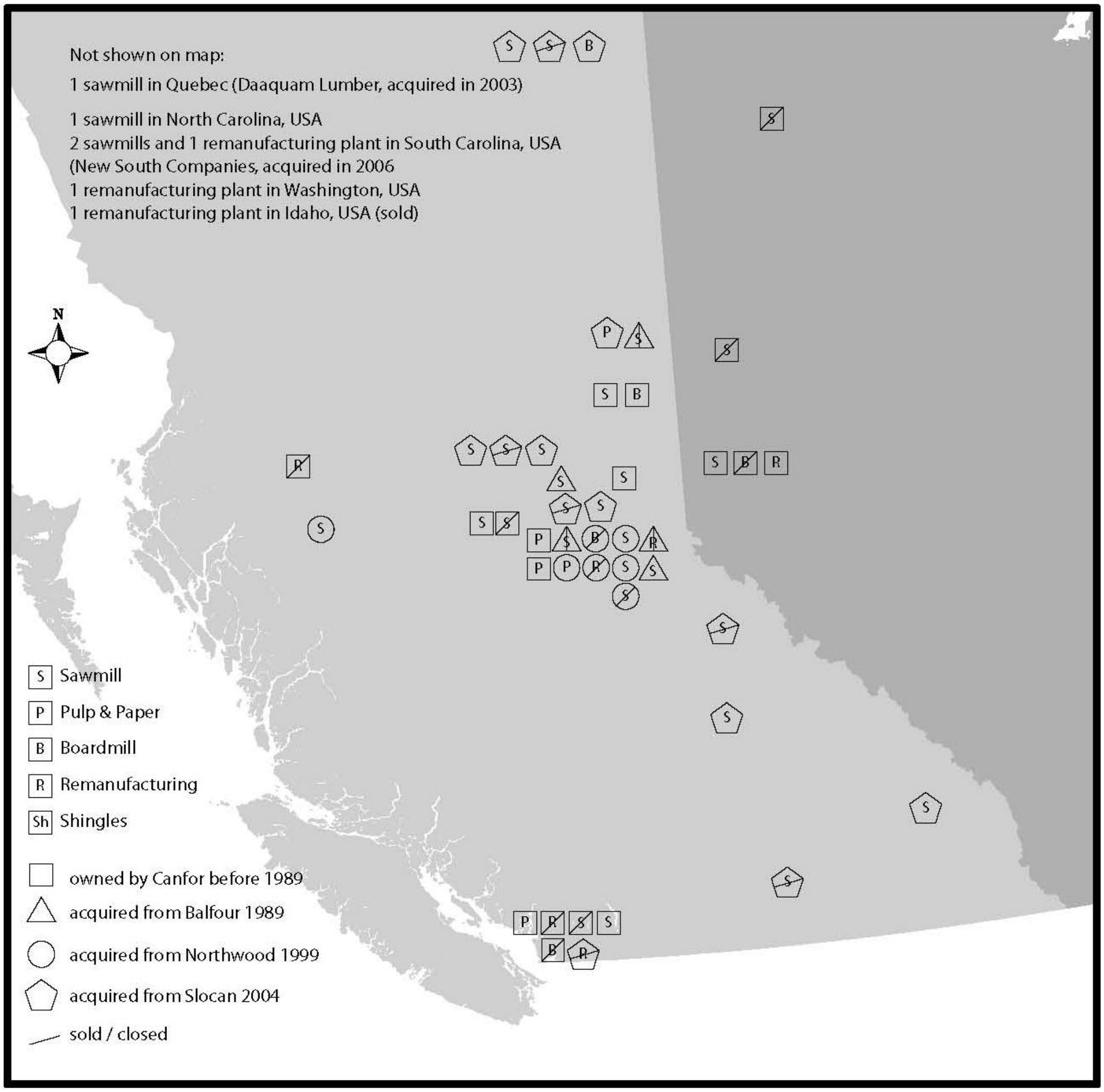
Capacity increase through major acquisitions in Western Canada	
1999	Northwood purchased for $635 million: 4 sawmills in Houston, Prince George and Upper Fraser (1 billion BF annual capacity), 1 plywood mill in Prince George, 1 remanufacturing plant in Prince George, 1 pulp mill in Prince George (550,000 tons annual capacity)
2004	Slocan acquired for $900 million 10 sawmills in Mackenzie, Quesnel, Radium Hot Springs, Slocan, Vanderhoof, Valemount and Vavenby (1.9 billion BF annual capacity), 1 plywood mill in Fort Nelson, 1 OSB mill in Fort Nelson, 1 remanufacturing plant in Chilliwack, 1 pulp mill in Taylor (220,000 tons annual capacity)
Geographic diversification and movement out of Western Canada	
2003	Daquaam Lumber and Produits Forestiers AnticostiQuebec acquired for $40.6 million, 1 sawmill with an annual capacity of 150 MMBF and a logging operation
2006	New South Companies, North and South Carolina acquired for $181.6 million 3 sawmills with an annual capacity of 430 MMBF of southern yellow pine (SYP), 1 remanufacturing facility, 2 lumber treating plants
Rationalization through mill sales and closures	
1999	Netherlands Sawmill in Prince George closed due to high costs
2000	Northern Specialties remanufacturing plant closed (unprofitable)
2003	Taylor and Upper Fraser sawmills closed because of high costs
2004	Synergies after the Slocan takeover lead to the closure of the Clear Lake remanufacturing plant and two sawmills in Mackenzie and Quesnel.
2005	Closure of the Tackama and Hines Creek sawmills due to high costs and a lack of available fibre. The Fort St. James sawmill is sold as it was required by the competition bureau; the high-cost Valemount and Slocan sawmills were also sold.
2008	The North Central Plywood mill in Prince George is destroyed by fire and not rebuilt after. The Kyahwood Forest Product joint venture in Smithers and the Panel and Fibre Division in Vancouver are closed. The Chilliwack remanufacturing plant is sold to BID group.

(continued on next page)

Major capital investment	
1999	3-years sawmill upgrade program, focussing on improving productivity and efficiency; Modernization of Fort St. James, Isle Pierre and Chetwynd sawmills for $49 million; Upgrade of kraft paper machine and introduction of new chip handling system at PGPP; Co-generation turbine and new chip handling system at Intercontinental
2002	Replacement of the precipitator in the recovery boiler at PGPP ($10.6 million).
2003	$74 million are invested to introduce third shifts at the Fort St. John and Prince George sawmills and for the major expansion of the Houston sawmill
2004	Upgrade of Polar Board OSB mill: expansion of production and installation of a co-generation facility ($41 million)
2005	Completion of the new Peace Valley OSB plant (total investment of $140 million); modernization of the Plateau sawmill starts ($113 million investment until 2006); upgrade of the recovery boiler and installation of a co-generation facility at PGPP ($38.6 million)
2006	New energy system, pellet plant and planer at Houston sawmill ($34.4 million)
2007	New energy system, pellet plant and 2-shift expansion at Graham sawmill, NC ($21.2 million)
2008	Fibre and energy optimization of the Fort St. John sawmill; Upgrade of the Conway sawmill (SC); Replacement of the chip screening and in-feed system at PGPP
2009	New energy systems at the sawmills in Fort St. John and Mackenzie; Upgrade of the Darlington sawmill.
2010	Rebuild of Fort St. John sawmill completed ($47 million); upgrade of Chetwynd sawmill; new energy system at Prince George sawmill; New planer optimizers installed in various sawmills; Green Transformation Program in pulp mills ($39.9 million)

Source: Canfor annual reports

Figure 5.7 Canfor Corporation, major operations 1989-2010



Source: Canfor annual reports

5.3.6 Reflections on Canfor's Strategy.

The story of Canfor's survival is particularly striking when compared to the fate of MB. The two firms had much in common. Both were domestic companies and locally headquartered. Both started as small, family run enterprises in Coastal BC in the first half of the 20th century. Both companies grew into fully integrated forest product companies during the decades of Fordism. Their input, products and markets were comparable and where there were differences, they seemed to work in favour of MB, such for instance the company was a leader in flexible mass production and more committed to innovation and value added production, the first to open a subsidiary in Japan and the first to abandon continuous clear cutting. Until the mid 1990s, MB was about twice the size of Canfor regarding sales and employment. MB's net earnings and capital investment were higher and Canfor relied more on debt as a source of financing. Thus, MB's failure is surprising and stands in stark contrast to Canfor's survival.

In the terminology of Porter (1985), MB was a cost leader across a broad spectrum of forestry products during Fordism. During the 1980s and 90s the company adopted a strategy of flexible mass production seeking to shift towards value maximization across a more focused range of higher-value products (Hayter 2004a, 54). This strategy failed, resulting in the takeover of MB by Weyerhaeuser in 1999. Canfor's initial positioning was similar to MB's, albeit with a slightly smaller product portfolio. Canfor, however, relied on flexible mass production with the goal to become a focused cost leader in dimension lumber and pulp.

The growth, restructuring and successive failure of MacMillan Bloedel was subject of academic interest for a while, which resulted in a number of studies (Barnes et al. 1990; Barnes and Hayter 1992; Hayter 1976; 1997; 2004a; 2008b). For a long time, MacMillan Bloedel represented the largest, most fully integrated and geographically diversified example of a BC forest product corporation. The literature offers several explanations for the company's demise. First, MB probably overestimated its abilities to shift to flexible mass production while remaining diversified across the forest product spectrum. Second, the volatility of BC's forest economy enticed MB to keep its diversification in both wood and paper products for too long, instead of focusing on the wood business.

Along with those explanations, which are rooted in MB's corporate strategy, MB's failure is also connected to certain corporate characteristics that result from the company's history and its specific development path. In such ways, the temporary acquisition of MB by Toronto-based Noranda, which controlled the company from 1982 to 1993, might have restrained MB from making necessary changes. In addition, most of MB's mills were clustered in three long established Fordist complexes at Powell River, Port Alberni and Nanaimo. Their break-up during the 1990 met substantial resistance of workers and communities. Furthermore, MB might be considered a "*special 'victim'*" (Hayter 2008b, 254) of place-specific circumstances. MB's assets were concentrated in Coastal BC. The region had the highest production cost in the province and was the main theatre of the War in the Woods. MB as the largest forest company in BC was explicitly targeted by ENGOs and incurred well-organized campaigns of blockades, boycotts and media attacks (ibid. 254). Changes in forest policy disproportionally affected MB due to its size and the location of its timber tenures (Hayter 2004a, 55). Thus, the company's sheer size and the location of its assets resulted in an especially strong exposure to the War in the Woods and to considerable contradictions, or mismatches, between MB's corporate structure and the changing institutional environment.

Particularly this becomes evident when comparing MB to Canfor. Although ENGOs and Aboriginal groups represented a threat to Canfor, no major incident was reported during the 1980s and 90s even though the company did own logging operations and sawmills on the Coast. Apparently, ENGOs chose MB, the largest and best known forest company in BC, as their main target for their campaigns, although most certainly its forestry practices did not differ much from Canfor's.

It remains arguable whether Canfor's survival is rooted in a different strategic focus, as during the 1980s and 1990s both companies had a comparable spectrum of products. Likewise, they responded in similar ways to the recession of the 1980s, rationalizing, cutting costs and abandoning unprofitable business lines, such as shingles and shakes and plywood. Furthermore, neither company pursued its intended strategy too strictly. In such ways, although MB focused higher value products, the production of standardized pulp and newsprint continued until the 1990s (Hayter 2008b, 242). Likewise, Canfor's product range included value added products, such as remanufactured lumber and specialty paper, even though the company's main goal was cost leadership.

One reason for Canfor's relative success is the fact that few of its assets were located on the Coast. Although the company originated in Coastal BC, the centre of its activities soon shifted to the Northern Interior. Therefore, Canfor was less exposed to the institutional shifts that took place on the Coast. In addition, the company did not own large, integrated forest industry complexes; instead, its mills were dispersedly located across BC and northern Alberta. Thus, Canfor was able to treat each sawmill as a single asset that could be modernized, expanded, downsized, sold to another company, closed temporarily or permanently as it pleased, without facing more resistance than the one from the (isolated) union local. Those options provided considerable operational flexibility; for instance overall productivity could be increased by closing high cost sawmills and allocating the associated timber supply to lower cost mills. The dispersed location of Canfor's mills also allowed for geographical flexibility. MB was "tied down" to the Coast, spending substantial resources for the in-situ restructuring of its large integrated complexes, partly due to business logics but certainly also due to the commitment to its grown "company towns". Canfor was able to shift the pivot of its operations away from the Coast with its high logging costs, environmental and Aboriginal conflicts into the Northern Interior by selling or closing Coastal assets and acquiring and building mills elsewhere.

With the exception of the shift away from the Coast and later out of Western Canada, Canfor's mill closures are not subject to any particular strategic or geographic pattern. Certainly, "redundant" mills in a given region are closed after a takeover, such as the Netherland sawmill in PG, to supply the fibre to other mills in the area. However, mills were also closed in locations where Canfor had no assets before, such as Slocan. Cost is clearly the dominating factor determining mill closures. Likewise, there is no evidence for the specialization of particular sawmills in terms of product or tree species.

A major reason for Canfor's survival is its corporate strategy. The company rigidly committed to efficiency, productivity increase and cost cutting in order to maximize profit, return to capital and shareholder value. The most remarkable strategy and major difference to MB is the steady capacity expansion by means of strategic acquisitions. This also resulted in the gradual shift of Canfor's corporate activities from the Coast to the Northern Interior. Successively, the company took over Balfour (1989), Northwood (1999), Daaquam Lumber and Produits Forestiers Anticosti in Quebec (2003), Slocan (2004), and the New South companies in the Southern US (2006), eventually becoming BC's largest forest company and cost leader for pulp and dimension lumber. MB abstained from such strategy, either to avoid overexpansion (already being BC's largest forest company) or because the in-situ restructuring of its integrated industry complexes consumed all disposable resources.

It has been argued that one of the reasons for MB's failure was that the firm missed out on divesting its pulp and paper operations as early as in the 1980s instead of waiting until the late 1990s (Hayter 2004a, 54). Looking at Canfor, this argument becomes ambiguous. Canfor was successful as a diversified company, producing both wood and pulp and paper products. As noted above, the separation of the pulp and paper business into a "Pulp Income Trust" might have been rooted in the intention to reduce corporate taxes (see Jog and Wang 2004, 855) rather than abandoning those product lines. It remains unclear whether focusing on one single business line would be a better strategy. Certainly, a major advantage would be that corporate resources could be bundled into one segment instead of spreading them. However, recessions in the past tended to affect the lumber and pulp markets in different ways and therefore a focus on one segment would likely increase volatility.

Despite the – tentative – success of Canfor's restructuring, the question arises of whether its strategy can be viable in the future. Most of Canfor's growth stems from predation upon its competitors, a strategy that is clearly limited by financial resources, by the risk of overexpansion and last but not least by the Competition Bureau. Much of Canfor's competitive advantage of being a cost leader is derived from the synergies with acquired companies, which in the past allowed for reducing the workforce and exploiting economies of scale at the corporate level. In general, the question remains whether a strategy that exclusively relies on low-costs can be sustainable. Apart from its consolidation period in the 1990s, Canfor seems to have given up its commitments on innovation. The international expansion in the 2000s makes it doubtful whether the company is committed to further investment in BC. Furthermore, Canfor is clearly not interested in a further engagement in the value added sector, as of in 2010 the company owned a single remanufacturing plant. Thus, much evidence points to the fact that the company has remained a corporate dinosaur, albeit with a changed structure. In the future, innovation and growth will have to come from smaller firms.

5.4 Conclusion

The 1980s recession and subsequent crises threatened the viability of firms and the industry as a whole. There has been widespread consolidation and rationalization within the leading commodity industries, and especially among the largest firms. The corporate giants that led the Fordist boom became sluggish dinosaurs that were unable to restructure and adjust. Most of them perished as the industry entered the plateau and consolidation became inevitable as an organizational structure locked-in into commodity mass production, vertical and horizontal integration, and firm level economies of scale had to cope with volatile demand, falldown and institutional change. Although Canfor has survived, it has remained a dinosaur; its changes have been modest at best – while it has reduced the extent of its vertical and horizontal integration in an operating sense it remains even more committed to cost minimization and commodity production. It is hard to say whether an alternative trajectory would have been possible. MB was the only Fordist giant to contemplate innovative changes in strategy and commit to value added production, but it too failed. No other major BC forest corporation has sought to diversify or become part of the emerging value added sector. The commodity and value added sectors remain as two solitudes.

The case of Canfor raises further questions about path-dependency and corporate evolution. Exogenous shocks and volatility had limited effects on firm behaviour and triggered less restructuring than expected (and observed at the aggregate industry level). It remains uncertain what were the reasons that prevented adjustment and change and whether they are rooted in the corporate structure of BC's forest industry (such as a particularly strong lock-in) or in the nature of the crisis (such as a prolonged period of volatility instead of a new stable 'equilibrium').

6: BOOMING AND BUSTING: LOCATION ADJUSTMENTS BY SURVIVING SAWMILLS 2000-2008

6.1 Introduction

The early years of the new century were characterized by a remarkable boom in lumber demand in connection with an ample supply of beetle wood. The boom was led by the rapid growth of US housing market, itself fed by the easy money provided by sub-prime markets. However, for BC's sawmills this boom was marred by the imposition of harsh duties and anti-dumping penalties by the US following the termination of the 1996 SLA in 2001. Then in 2007/08, this boom became a ferocious bust as the US housing market crashed with the collapse of the sub-prime mortgage markets. Moreover, in 2006 a third SLA was signed by the Canadian and American federal governments, imposing a tax on Canadian lumber exports. As the price declined this created a "perfect storm" of sharply reduced demand and rising taxes. The 2000-2008 period may not constitute a turning point but in terms of volatility, it was comparable if not even worse than the 1980s recession.

This chapter examines how surviving sawmills responded 'in situ' to this volatility and contributes to a geographic literature on firms' responses to recessions that has focused on plant closures as the most visible and evident way of responding to crisis (see for example Bluestone and Harrison 1982; Kirkham and Watts 1997; Massey and Meagan 1982; Stafford and Watts 1991; Watts and Kirkham 1999; Watts and Stafford 1986). However, plant closures are just one way of restructuring, multi-plant firms can also sell a plant to another firm or reduce employment in-situ (see Watts and Stafford 1986, 206). In-situ restructuring often leads to severe conflicts between management and the workforce as it involves the re-negotiation of existing collective agreements. Thus, it has strong implications for sawmills and communities (see Barnes et al. 1990; 2001; Barnes and Hayter 1992; 1997; Hayter et al. 1994; Hayter and Barnes 1992; 2001).

Large forest corporations have various ways of adjusting their strategy in response to a recession (chapter 5). In the short run the focus lies on cost cutting and rationalization, for example through layoffs, reducing the number of shifts or temporary mill closures. In a longer perspective, possible strategies include the introduction of new technology and new forms of industrial organization, new or modified products, the shift to different export markets and strategic expansion through acquisitions. In principle, one would expect the responses of a single sawmill to be a subset of these strategies, given limitations of financial and human resources.

Nevertheless, it is hard to predict the outcome of a recession for a single mill. First, crises tend to have an ambiguous effect on restructuring. On the one hand, they may spur innovation and adaption to survive in the long term. However, recessions also severely limit a mill's capabilities to undertake new projects, for financial reasons and because layoffs can reduce the knowledge and experience of the workforce (Hayter 2000, 97f). If a large company such as Canfor abstains from major projects in times of crisis, the same might be expected for a small, owner-run sawmill. Second, multi-plant firms enjoy discretion as to where they close, downsize, expand, and adapt operations; selective mill closures could result in the concentration of workers and production in the remaining mills. High fixed costs and strong economies of scale can make this strategy especially worthwhile.

The chapter particularly focuses on the nature and extent of adjustments made at existing factory sites on the production side (employment, wood fibre, investment and technological change) and on the demand side (market and product diversification). Did firms at their existing sites adjust employment levels, skills and organization during this period of volatility? Did sawmills try to become more efficient and lower cost? Did sawmills seek to add value to products, diversify products and markets, the latter especially away from the US? Is the latest period of volatility just another crisis or has it (finally) provoked adjustments? The analysis of these questions is based on a field survey of sawmills conducted in the summer of 2009. In practice, in situ adjustments take on a variety of forms. The results confirm a dual industry structure along the lines of flexible mass production and flexible specialization, and differences between large and small mills are important.

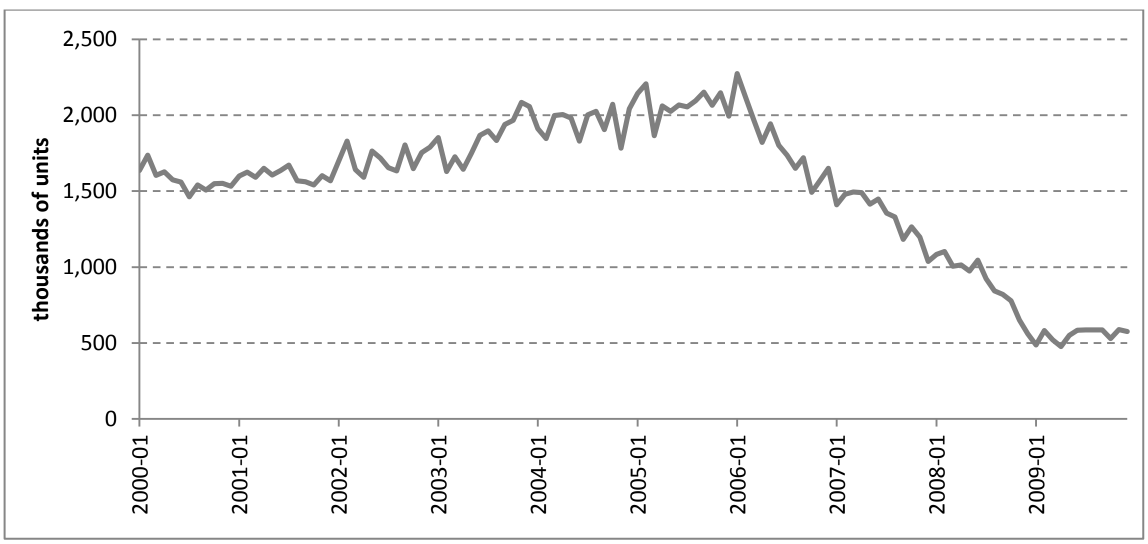
6.2 The 2000s: Boom, Bust and Volatility

From 2000, BC's forest industry experienced a boom, which was succeeded by a decline of unprecedented dimensions from 2006. This recession constituted a "perfect storm" for BC's forest industry through a vicious collusion of the US housing market decline, the US-Canadian Softwood Lumber Agreement and the pine beetle epidemic.

The downturn was driven by the demand shock of an abrupt and massive decline of the US housing market, which resulted in tumbling export prices. During the early 2000s, the US housing market experienced the "*biggest bubble in history*" (The Economist 2005). That boom was a global phenomenon and it is estimated that from 2000 to 2005 the value of residential property in developed countries increased by more than US$30 trillion. The increase in US housing starts was driven by low interest rates and low perceived returns on the stock market after the breakdown of the dot-com bubble. Furthermore, innovations on the financial markets, such as subprime mortgages, made property available for an increasing number of people. That boom came to a sudden stop in fall 2005; housing starts tumbled, from January 2006 to April 2009 they dropped by 79% (figure 6.1). The US housing market is the most important driver of export demand for BC wood products, absorbing dimension lumber for construction, building materials and various other wood products. Therefore, the burst of the housing bubble had severe consequences for the industry.

Figure 6.1 US housing starts 2000-2009

(Monthly data, seasonally adjusted)



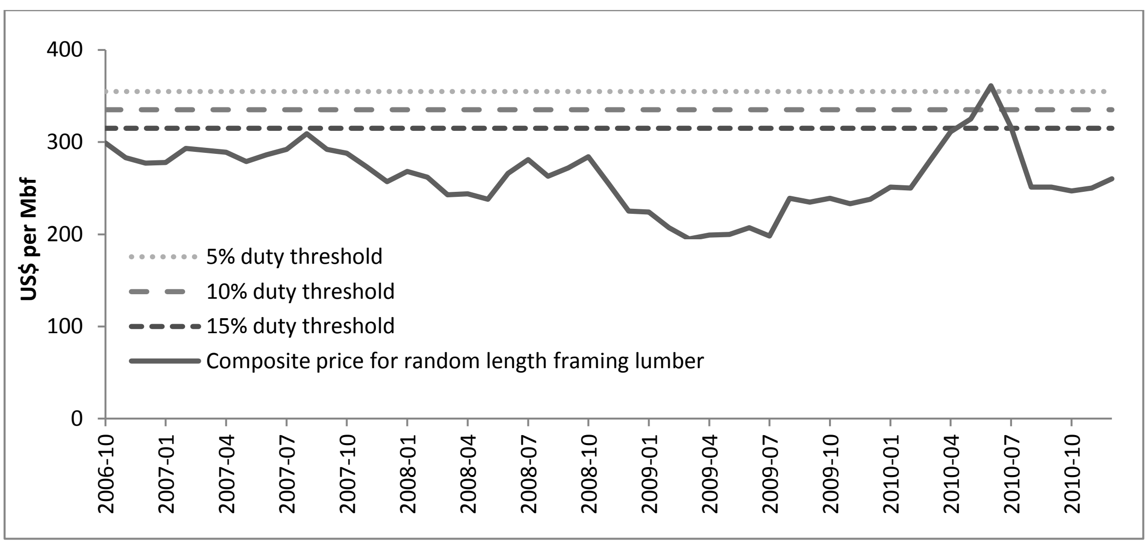
Data: US Census Bureau

There is a multitude of different wood products, each with its own price. For that reason, trends on the lumber market are summed up using a composite price. By convention, this composite consists of a weighted average of fifteen structural lumber products; it is published monthly by Random Lengths Publications Incorporated, an

Oregon-based forest industry think tank. The framing lumber composite price is also the base for the duty assessment of the 2006 SLA.

That composite price is not what BC producers actually receive. Their revenue is lower due to the duties imposed during the different stages of the softwood lumber trade conflict. In August 2001, the US Department of Commerce levied a countervailing duty of 19.31% on Canadian softwood lumber exports. In October 2001, an additional “anti-dumping” duty of 12.57% was imposed, such that the total duties summed up to 31.88%. In April 2002, the Department of Commerce lowered the countervailing duty to 18.79% and the anti-dumping duty to 8.43%, which resulted in a total duty of 27.22%. The duty regime changed again after the 2006 SLA in October 2006 when it was replaced by an export charge depending on the Random Length composite price, a regulation that has been in place since. Exports face no charge if the price is over US$355 per MMBF; the charge is 5% if the price is between US$336 and 355, 10% if it is between US$ 316-335 and 15% if it is US$ 315 or below (figure 6.2). From October 2006 through April 2010, the composite price happened to be always lower than US$335 and thus the full 15% export charge applied.

Figure 6.2 Framing lumber composite price and duty thresholds 2000-2009

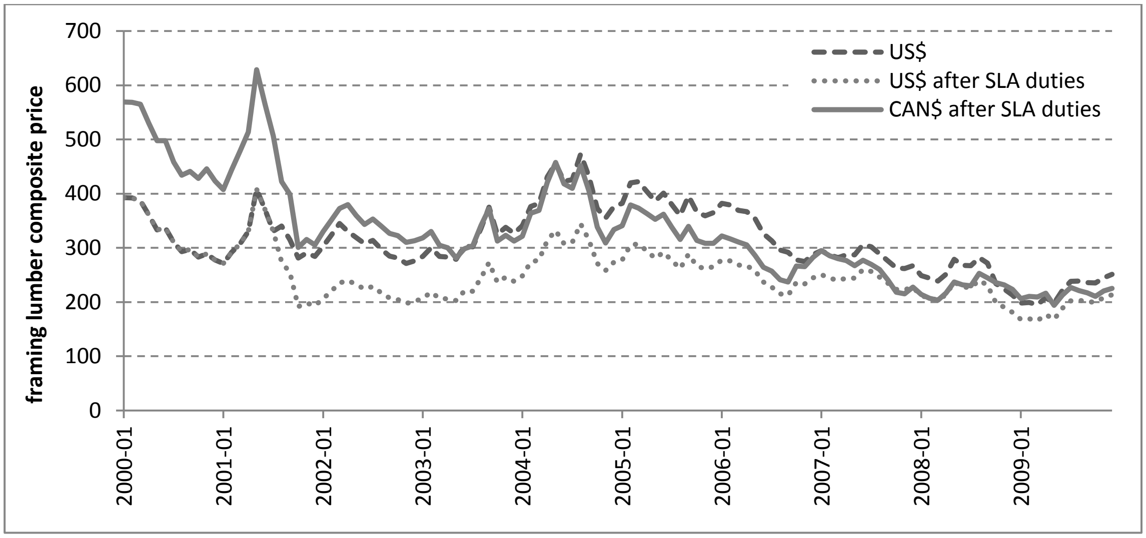


Data: Foreign Affairs and International Trade Canada (http://www.international.gc.ca/controls-controles/softwood-bois_oeuvre/index.aspx?view=d, retrieved September 12, 2011)

In addition to tariffs and duties, the price BC lumber producers receive is affected by the exchange rate between US$ and CAN$. The combination of those two effects results in a considerable increase of volatility and uncertainty (figure 6.3). From August 2004 to January 2009, the composite price after duties (in CAN$) dropped by 54%.

Figure 6.3 Framing lumber composite price after duties in CAN$ 2000-2009

(Monthly data)



Data: composite price: Random Length (www.randomlength.com); exchange rate: Statistics Canada (CANSIM series v37426)

6.2.1 Industry Responses 2000-2008

The change of key industrial variables for BC's sawmills are summarized in table 6.1. Due to the financial crisis, employment, shipment and exports almost dropped in half between 2000 and 2008. Consolidation led to decreasing capacities and larger mills. Evidently, the most variable dynamics took place in the Interior, while the Coast stagnated or declined. Although mills closed in both regions, new capacity was created in the Interior, where a vast uplift of beetle-infested wood provided an increasing timber supply. A beacon for this trend is the construction of super-sawmills like Canfor's Houston mill with an annual capacity of 600 MMBF. However, arguably a consequence of the uncertainty generated by the Canada-US trade conflict, most of the duties that were returned after the 2006 SLA were invested in the US and other regions. As a whole, the period from 2000 to 2008 reflects the overall experience of BC's forest industry since the 1980s crisis: Booms, busts and increased volatility. The effects of the volatile business environment on BC's sawmills shall be explored in the following.

Table 6.1 BC, change of selected parameters of sawmills 2000-2008

		2000	2008	Change 2000-2008 (%)
Number of sawmills[1] (over 40 MMBF/year)	Coast	36	21	-41.7
	Interior	77	62	-19.5
	total	113	83	-26.5
Total capacity[1] (billions of BF/year	Coast	4.0	2.4	-40.0
	Interior	10.8	11.3	+4.6
	total	14.7	13.7	-6.8
Average capacity[1] (MMBF/year)	Coast	111	112	+0.9
	Interior	140	182	+30.0
	total	130	165	+26.9
Capacity utilization[1] (%)	Coast	77	64	-16.9
	Interior	98	85	-13.3
	total	92	81	-12.0
Lumber recovery factor[1] (000 board feet per m^3)	Coast	0.222	0.232	+4.5
	Interior	0.263	0.272	+3.4
	total	0.253	0.269	+6.3
Employment (Sawmills, planing and shingle mills)		27,796	15,127	-45.6
Shipments (billions of $) (Sawmills, planing and shingle mills)		9.5	5.0	-47.4
Lumber production (millions of m^3)		34.4	28.9	-16.0
Lumber exports (billions of $)		6.8	3.6	-47.1

[1] Sawmills over 40 MMBF/year

Source: Statistics Canada, Principal Statistics (CANSIM tables 3010002, 3010003, 3010006); BCMoF (2011); BC Financial and Economic Review

6.2.2 The Survey

In order to explore the effects of the recent recession on BC's sawmills, fieldwork was conducted in summer 2009. Due to limited time and resources, the survey was restricted to sawmills only, other industries, such as remanufacturing plants, were not considered[19]. Sawmills are the backbone of BC's forest industry and the core of the wood value chain. They are the most important sub-industry regarding their share of employment. Sawmills are located across all regions of BC; they are less differentiated and more comparable with respect to their operational focus than other sub-industries. In addition, sawmills exhibit a considerable size differentiation, from small establishments with less than ten workers to plants employing hundreds of people; this allows for the analysis along the lines of a dual industry structure.

[19] The selection was based on the classification of the plant in industrial directories.

Sawmill operations in different regions of BC reflect the species mix and thus the available fibre quality and quantity. The goal was to obtain a sample of sawmills of different size and ownership. Therefore, in each research region a mix of small and large establishments was selected for being interviewed. The sample consists of both single and multi plant firms. Furthermore, two recently closed mills were included. Interviews were conducted with the owners and managers of 22 sawmills in total, using a structured questionnaire (appendix B). Each interview was recorded and transcribed. In addition, open interviews were conducted with three industry organizations, one wood trading company and one labour union, in order to get background information about the forest industry. The Fieldwork was conducted in summer 2009 (from May to September). The research regions selected for the fieldwork were the following:

- Vancouver Island and the Lower Mainland (CO);
- Okanagan/Northern Cascades (OK);
- South-Eastern BC (Grand Forks/Nelson/Creston) (SE);
- Central Interior (the Cariboo Region around Williams Lake and Quesnel) (CI).

These regions represent the most important areas of the province with respect to their physical geography and their forest industry traditions. In such ways, the four research regions represent different environmental conditions with the resulting variation in species, fibre quality and exposure to the mountain pine beetle. One area is located at the Coast, three in the Interior, in order to investigate the differences between the two traditional forest regions. Furthermore, the goal was also to examine whether proximity to the US border influences plants' strategy and dynamics.

In order to obtain a good representation of the sawmill population, a stratified sample of large and small sawmills were interviewed in each research area. Altogether, 22 mills were interviewed (table 6.2).

Table 6.2 Sawmill survey, sample size and regional distribution

Research region	# of mills	% of mills
Coast/ Lower Mainland	6	27.3
Okanagan	6	27.3
South-Eastern BC	5	22.7
Central Interior	5	22.7
Total	22	100.0

Data: fieldwork

Employment in the interview mills varies from five employees to more than three hundred. Likewise, output is very differentiated (table 6.3). Based on their output and employment in 2008, the sawmills were classified into “small” mills with less than 150 employees or a production of less than 100 MMBF per year, and “large” sawmills with either an annual production of more than 100 MMBF or more than 150 employees. Altogether, there are ten small and twelve large mills. It should be noted, however, that this is a useful but still blurred distinction; there is more of a size distribution of firms and plants than a simple dual structure. In such ways, some mills belong to giant multi-plant firms, other large mills are locally owned. Likewise, the “small” sawmills” category includes sites near the boundary of the size criterion, producing close to 100MMBF annually and sawmills with a handful employees.

Table 6.3 Sawmill survey, size distribution

Mill size	**Criteria**	**# of mills**	**% of mills**	**Average output (MMBF/year)**	**Average employment**
Small	<100 MMBF/year or <150 employees	10	45.5	26.4	58.1
Large	≥100 MMBF/year or ≥150 employees	12	54.5	164.4	207.3

Data: fieldwork

Only two sawmills in the sample (both large) are owned by foreign corporations. This low number reflects the withdrawal of foreign companies from the province over the last two decades and the shift towards a domestically controlled industry.

Seven out of the 22 sawmills in the sample are single plant firms. There are clear differences with respect to the size distribution, single plant firms tend to be smaller (table 6.4). Note that considerable qualitative differences exist between multi-plant firms; some sawmills are part of giant forest corporations with dozens of mills, others are locally owned sawmill that own for example a separate pole mill or a small remanufacturing plant. While most small mills belong to small single plant firms and vice versa this is not always the case. In such ways, one single plant mills operates five sawmills at the same site (CO 3, large). Likewise, some small mills are part of local firms that own two or three mills in the region (CI 2, CO 5, both small). One small mill belongs to a giant corporation and was downsized due to the crisis (CI 2, small).

Table 6.4 Sawmill survey, single and multi plant firms

Mill size	Single plant firms		Multi plant firms	
	# of mills	% of mills	# of mills	% of mills
Large	3	33.3	9	62.5
Small	4	66.6	6	37.5
Total	7	100.0	15	100.0

Data: fieldwork

Alternatively, the sawmills can be classified with respect to their ownership (table 6.5). This classification is correlated with mill size and single/multi-plant firms, although not perfectly. BC's sawmill landscape is diverse and although a distinction into a dual industry structure is justified, it does have limitations. In general, the table reflects the fact that BC's sawmills are increasingly under domestic and even local ownership and control. Only six mills, less than one third, are part of large forest corporations such as Canfor, West Fraser or Western Forest Products.

Table 6.5 Sawmill survey, ownership

	Total	Single plant firms	Multi-plant firms	Small mills	Large mills
Part of large forest corporations	6	0	6	1	5
Part of large family owned firms	5	1	4	0	5
Part of small family owned firms	7	3	4	7	0
Locally owned custom-cut mills	3	2	1	2	1
Co-operatives	1	1	0	0	1
Total	22	7	15	10	12

Data: fieldwork

6.3 In Situ Location Adjustments

6.3.1 Employment

Between 2001 and 2008, 12 out of 22 sawmills reduced their workforce (table 6.6). One would expect this result because rationalization and downsizing are typical responses to a recession. Surprisingly, however, six mills expanded employment; three of them increased their workforce by more than 50%.

Table 6.6 Sawmill survey, employment change 2001-2008

Employment change	# of mills	% of mills
Increase, 50% or more	3	13.6
Increase, up to 50%	3	13.6
No change	2	9.1
Decrease, up to 50%	9	40.1
Decrease, 50% or more	3	13.6
N/A	2	9.1

Data: fieldwork

Mills increase employment for multiple reasons; for example, in one multi-plant firm the closure of six mills in BC has led to consolidation in one surviving mill (table 6.7). The small mills that increased employment also increased output while two other large mills increased employment while diversifying and adding labour intensive activities respectively. Two mills are custom cut mills without own timber supply which face increasing demand due to the closure of many mills.

> *What we're doing is providing service. We have to cut the wood in time, because the customer probably wants to put it on a ship in three days. If that entails bringing in a couple of extra people tonight and tomorrow, in order to get his boom of logs processed then that's what we have to do.* (CO 3, large)

Table 6.7 Sawmill survey, reasons for increasing employment 2001-2008

Mill	Size	Single/ multi-plant firm	Reason
OK 1	large	multi	increasing employment due to selective closure (only mill left in BC)
OK 2	large	multi	increasing production due to market diversification
SE 1	large	multi	more labour intensive production (higher value products)
CO 6	small	multi	increasing production (custom cut mill)
OK 6	small	multi	expansion (small firm)
SE 5	small	single	increasing production (custom cut mill)

Data: fieldwork

Thus, the picture of employment change at the level of the individual mill is differentiated, and in general, there is no relation between mill size and the direction or magnitude of employment change (table 6.7). Some large mills increased employment while there are small mills that reduced employment and vice versa.

There is some evidence for a regional differentiation of employment change. The Coast is especially affected by the crisis, which is confirmed by the findings of chapter 4 and by the following quotes:

> *We are literally in survival mode in this company.* (CO 2, large)
>
> *We can stand anything but it is certainly not much fun right now.* (CO 5, small)
>
> *I think, in five or 10 years we'll look at [the Coastal forest industry] and it'll be a cottage industry, you know, mom and pop shop.* (CO 3, large)

The picture in the Okanagan and the South-East seems to be slightly more diversified; five of the six plants with increasing employment are located in those regions. However, it is uncertain whether this is the case due to regional effects or due the random selection of mills.

The most important union for forest industry workers in BC is the United Steelworkers (USW). Out of 22 mills in total, 10 are unionized (almost half), including six of twelve large sawmills (50%) and four of ten small mills (40%). Such a high percentage for small mills is surprising and can be explained by the fact that three of those four mills would have been classified as large mills in 2001 and thus the unionization is a relic from those days. The relatively low unionization of large establishments particularly indicates a weakening union strength since the heydays of Fordism. There is no discernible difference in unionization rate between the four regions.

Even in non-unionized establishments, the union is a benchmark for labour organization, wages and benefits. Thus, in 18 out of 22 sawmills some form of seniority principle is applied, albeit non-unionized mills tend to emphasize competency. Furthermore, out of the 12 non-unionized mills three have a collective agreement similar to unionized plants. In 15 mills some form of job rotation is practiced, ranging from a fixed schedule over informal rotation to a cross training of the employees to have a backup for all positions. There are hardly any differences regarding job-rotation between union and non-union establishments (table 6.8). This convergence of the industrial organization of union and non-union mills seems to indicate declining union power. However, the union is still able to negotiate effectively and indeed won a surprisingly good collective agreement in 2007 at a time when the employers seemed to be highly fragmented. Furthermore, as noted, the union is still a benchmark for non-union mills.

Wages went up. We negotiated wage increases in each year in the three years collective agreement, and benefits. You know, overall, when you consider the times, we did remarkably well. (Interview with USW)

Table 6.8 Sawmill survey, job rotation

Employment change	**Unionized mills**		**Non-unionized mills**	
	# of mills	**% of mills**	**# of mills**	**% of mills**
Formal job rotation	4	33.3	3	30.0
Informal job rotation	5	41.7	5	50.0
No job rotation	3	25.0	2	20.0

Data: fieldwork

Most mill owners and managers state that they are on favourable terms with their workers and the union. Cooperation between management and the union is common but limited to certain issues, such as work safety. While some managers explicitly state that they want to keep the union out, that is often the reason for paying higher wages and more benefits than unionized mills. In such ways, a study performed by one of the interviewed mills yielded that employees would earn $335 less on average if they were union members (OK 2, large). Therefore, the relationship between workers and management in small and large mills alike can take on rather traditional and sometimes paternalistic forms, as the following quotes demonstrate.

We do not require a union because we look after our people. (OK 2; large)

We are still small enough that we know everybody by name and their wives and children and their birthdays. Keep them happy. If there is a problem we encourage them to bring it to us on the day, you know, we don't wait until a meeting at the end of the month. (SE 1; large)

The owner hands out the paychecks personally. Therefore, when he's going around every two weeks [...] if an employee has a problem, what better way to give his complaint out? The owner writes all of this down and we deal with them every week. [Company name] is in many ways very informal, there are no policy manuals and all that stuff. (CO 3; large)

In the future, an aging workforce could become a problem for the industry. In four mills the average worker was older than 50 (table 6.9), average age was between 40 and 50 and below 40 in seven mills each. The age of the workforce does not differ much between large and small mills. Due to seniority, unionized plants tend to have an older workforce; younger employees are the first ones to be laid off during a recession.

Table 6.9 Sawmill survey, average age of workforce

Average age	**Small mills**		**Large mills**	
	# of mills	**% of mills**	**# of mills**	**% of mills**
Below 30	2	20.0	0	0.0
31-40	2	20.0	3	25.0
41-50	3	30.0	4	33.3
Over 50	2	20.0	2	16.7
N/A	1	10.0	3	25.0

Data: fieldwork

On the positive side, an aging workforce reflects the strong interest of many mill owners and managers in a stable, long-run relationship with their employees.

> *You've been here 10 or 15 years, you're junior.* (OK 2, large)

However, the retirement of sawmill workers over the next ten to twenty years could lead to a shortage of labour that is not met by an adequate supply of young recruits, because many apprentice programs were curtailed to save costs. Out of the 22 interview sawmills only eight had at least one apprentice. Although the risks associated with an aging workforce are recognized in many sawmills, a solution is not easy to find. It is evident that due to high and continuing volatility many young people do not see a future in working for the forest industries and instead seek employment in mining or in the Albertan oil sands.

> *We have maintained the same level of people here. It has been hard to find trades [people] in the last couple of years, and I don't know if that is a function of the drain to Alberta, or the mining sector, but there is more competition for those trades people.* (CI 4, large)

> *...when we started to see the downturn in 2006 we were losing labour to the oil patch and mining industry, which were both doing well. Now, were all kind of in the dumpster, retaining labour in any of the resource industries will be a challenge*. (Interview with COFI)

There are little differences with respect to wages between small and large mills (table 6.10). This convergence contradicts the findings at a higher aggregation that wages are higher in large establishments. However, it is likely that surviving mills are more productive on average and can afford higher wages. Likewise, the difference between union and non-union mills is small, at least in large mills. However, most small mills are in the value added segment and were not examined in this study.

Table 6.10 Sawmill survey, average hourly wages

($, benefits not included)

Small mills	unionized	26.8
	non-unionized	22.3
	total	24.1
Large mills	unionized	27.7
	non-unionized	26.2
	total	26.9

Data: fieldwork

6.3.2 Output and Productivity

The pattern of output change is variable (table 6.11). Seven mills increased production and eight reduced output; four mills experienced no change. The mill size does not seem to have an influence on output change and there is no discernible regional differentiation. Rather, outcomes depend much on the individual mill, its products, the skills and experience of management and workers, and the corporate context.

Table 6.11 Sawmill survey, output change 2001-2008

Output change	# of mills	% of mills
Increase, 50% or more	3	13.6
Increase, up to 50%	4	9.1
No change	4	9.1
Decrease, up to 50%	3	13.6
Decrease, 50% or more	4	9.1
Decrease, magnitude unknown	1	4.5
N/A	3	13.6

Data: fieldwork

Especially interesting are the seven cases in which sawmills increased production against the trend (table 6.12). The reasons for increasing production vary and overlap with those for employment increases. Four mills belong to large multi-plant firms, such as Weyerhaeuser, West Fraser and Canfor, in which selective closure is an important reason for increasing production. However, two large mills (OK 2 and SE 4) experienced overall growth among virtually all operations. Those two mills both belong to family-owned firms.

Table 6.12 Sawmill survey, reasons for increasing output 2001-2008

Mill	**Size**	**Single/ multi-plant firm**	**Reason**
CI 1	large	multi	selective closure, specialization in beetle wood
CI 4	large	multi	selective closure, specialization in beetle wood
OK 1	large	multi	selective closure, only sawmill remaining in BC
OK 2	large	multi	good market perspectives
SE 4	large	single	good market perspectives due to diversification (no major changes in product line)
CO 6	small	multi	custom cut mill

Data: fieldwork

Institutional and economic change imposed considerable pressure on the mills that to varying degrees encouraged innovation, rationalization and productivity gains. Most mills operate with the most up-to-date technology; they reduced their workforce and adjusted their organizational models. Out of the 22 interviewed sawmills, 13 indicated a strong productivity increase, two a moderate increase (table 6.13). Those findings are in line with the broad industry trend. There is no relation between mill size and productivity change discernible and neither is there a regional pattern.

Table 6.13 Sawmill survey, trends in sawmill productivity 2001-2008

(Multiple answers were possible)

Productivity trend	**Small mills**			**Large mills**		
	# of mills	**% of mills**	**Reasons (# of mills)**	**% of mills**	**% of mills**	**Reasons (# of mills)**
strong increase	5	50.0	technology (5), improved labour organization (5), expansion (2)	8	66.7	technology (4), improved labour organization (2), decreasing labour cost (reduced workforce) (2), expansion (2)
moderate increase	0	0.0	N/A	2	16.7	technology (1), expansion (1)
no change	3	30.0	N/A	0	0	N/A
decrease	1	10.0	reduced production due to lack of sales (1)	2	16.7	increasing labour costs (1); deteriorating fibre supply due to MPB (1)
N/A	1	10.0	N/A	0	0	N/A

Data: fieldwork

Three mills, two large, reported productivity decreases. One case (large) is rooted in deteriorating fibre quality due to the MPB and in two cases productivity decline was related to output reduction, because economies of scale result in rising unit costs when output is reduced. Market conditions require operating at reduced capacity, but once output falls below a certain threshold, the mill becomes increasingly unprofitable due to high fixed costs.

A commonly used measure for sawmill productivity is the lumber recovery rate; it measures the percentage of the lumber weight that is retained as product in the sawing process. Lumber recovery differs according to the product and the tree species used, but the trend in one and the same mill provides a good proxy for productivity (table 6.14).

Table 6.14 Sawmill survey, changes in lumber recovery 2001-2008

(Multiple answers were possible)

Lumber recovery trend	Small mills			Large mills		
	# of mills	% of mills	Reasons (# of mills)	# of mills	% of mills	Reasons (# of mills)
strong increase	2	20.0	technology (1), better fibre quality (1)	5	41.7	technology (3), skilled workforce (1),
moderate increase	1	10.0	N/A	1	8.3	technology (1)
no change	3	30.0	N/A	1	8.3	N/A
decrease	1	10.0	focus on quality rather than lumber recovery (1)	3	25.0	pine beetle (2), shrinkage due to kiln dried wood (1)
N/A	3	30.0	N/A	2	16.7	N/A

Data: fieldwork

Nine out of 22 mills experienced a strong or moderate increase in lumber recovery. The responses of large mills tended to be bi-polar. On the one hand, they rely heavier on the use of technology, on the other they are more exposed to the pine beetle. However, the effects of the pine beetle seem ambiguous and in spite of the blue stain, beetle wood can be used for a range of products. Furthermore, due to the MPB plenty of timber is available at low prices. Two (large) mills, both part of multi-plant corporations in the Cariboo region are even specialized on the use of dead beetle wood with a small diameter.

6.3.3 Export Markets

In general, export markets did not change dramatically between 2001 and 2008. The share of the US decreased and some mills tried to make up for their shrinking US-bound exports by increasing sales to the domestic market. There is evidence for a strong lock-in into export markets at the level of the individual sawmill. It is difficult and sometimes beyond the scope of a local company to develop new markets and establish connections with potential trade partners, in addition, years of downsizing and consolidation have taken their toll on companies' competencies.

> *Marketing is done out of Vancouver, and we have just downsized the whole company, so some of our head office marketing and sales have disappeared, too. That's a concern for me. I don't know, it's an international business and to stay in it you need international communication, and to lose that, I don't know how you do business. I think as the industry has gotten smaller we have lost* that capability. (CO 1, large)

Even though the US lost share, they were still the dominant export market in 2008 (table 6.15). Some mills, however, even increased their exports to the US compared to 2001 (both absolutely and percentage). Once again, the picture of restructuring is differentiated and depends on the individual mill and product. There are significant differences in the export pattern between large and small mills. In 2001 small mills have generally more diversified export markets whereas large mills tended to focus stronger on the US and Japan. Both large and small mills diversified their export markets during the financial crisis and increased shipments to the domestic markets.

Table 6.15 Sawmill survey, main export markets 2001 and 2008

Main export market	Small mills				Large mills			
	# of mills		% of mills		# of mills		% of mills	
	2001	2008	2001	2008	2001	2008	2001	2008
US	4	4	40.0	40.0	8	5	66.7	41.7
Japan	1	0	10.0	0.0	3	3	25.0	25.0
Canada (includes BC)	1	2	10.0	20.0	0	2	0.0	16.7
BC	1	1	10.0	10.0	1	1	8.3	8.3
Europe	1	1	10.0	10.0	0	0	0.0	0.0
Diversified markets	1	1	10.0	10.0	0	1	0.0	8.3
N/A (sells to broker)	1	1	10.0	10.0	0	0	0.0	0.0

Data: fieldwork

Export markets clearly vary between regions. While all of the mills that export to Japan are located at the Coast, the Interior mills tend to ship mostly to the US. Mainly on the Coast, some sawmills also increased their exports to China, reporting a share of up to 10-20% of total exports in 2008. In their majority, sales to China consist of lower grade products. Mainly large sawmills engage in exporting to China as multi-plant firms have more resources to develop new markets. Small mills tend to produce higher grades and are therefore less interested in China at the present.

> *We do a fair bit of business with China, but typically China doesn't buy the high grade and they purchase the low grade, utility, low prices. It's been a market, but it's a cheap part of the business. Ideally, they would start buying some of the higher grade wood*. (CO 1, large)

Despite this, China is seen as the new frontier.

> *China is the only opportunity that is left and you have to get the cost structure right for that.* (CO 2, large)

> *...but obviously, with the size of China that's the focus. And just a little bit on that, typically with a country like China you have to start right from the beginning, building codes, fire codes, because wood is not in those countries' culture the way it is here [...] So you're starting at ground zero to try and develop markets*. (Interview with COFI, Kelowna office)

6.3.4 Flexibility and Specialization in the Product Mix

The interviewed sawmills differ considerably with respect to product lines. In general, one can distinguish flexibility and specialization. Flexible mills are able to quickly respond changes with respect to fibre supply and markets, this is mainly achieved by a wide range of products.

> *This is one of the reasons why we still run, because we are cost effective and have flexibility.* (Ok 4, small)

In contrast, specialization provides mills with a competitive advantage in the production of one or a few standardized products; most of those mills rely on economies of scale.

An overview over the product lines of the interviewed mills is provided in table 6.16 and reveals the dual importance of flexibility and specialization. There are nine mills that rely on flexible strategies and thirteen specialized mills. Both strategies are used by large and small mills alike. Specialized mills, however, tend to be large, because large volumes of standardized products such as dimension lumber are subject to economies of scale.

Table 6.16 Sawmill survey, product lines 2008

Focus	Mill	Size	Product line 2008
Flexible	CO 3	large	custom cut mill, focus on the Japanese market
Flexible	OK 3	large	dimension lumber (40%), commodity (50-55%), J-grade. 75 products, strong customer focus
Flexible	SE 1	large	specialty mill with broad focus, large number of products, J-grade, laminate grade, structural wood,
Flexible	SE 4	large	specialty mill with broad focus, 200-350 different products
Flexible	CO 5	small	cedar specialty mill with broad focus, 400-450 products,
Flexible	CO 6	small	custom cut mill
Flexible	OK 6	small	cedar specialty mill, 27 core products, decking, panelling, siding, timbers
Flexible	SE 3	small	specialty mill with broad focus, diverse product range, multi-species
Flexible	SE 5	small	custom cut mill
Specialized	CI 1	large	100% dimension lumber, focus on dead beetle wood
Specialized	CI 3	large	100% dimension lumber
Specialized	CI 4	large	100% dimension lumber, focus on dead beetle wood
Specialized	CO 1	large	specialty mill, focus on the Japanese market, structural wood and beans (75%), baby squares (25%)
Specialized	OK 1	large	100% dimension lumber, only mill left in BC
Specialized	OK 2	large	specialty board producer,
Specialized	OK 4	large	specialty mill with focus on niche markets, decking, fencing, siding
Specialized	OK 5	large	used to be largest deckings manufacturer in Canada, closed in 2007
Specialized	CI 2	small	Specialty mill, panelling (75%), high end boards (25%)
Specialized	CI 5	small	high-end windows and doors, custom planing
Specialized	CO 2	small	strong focus on the Asian market, especially Japan, railway ties and timbers
Specialized	CO 4	small	cedar specialty mill
Specialized	SE 2	small	J-grade, dimension lumber

Data: fieldwork

Eleven sawmill changed their product line from 2001 to 2008 (table 6.17). Once again the picture is diversified. Product line changes are undertaken by large and small mills alike; small mills tend to shift towards more flexibility or higher value production, while large mills apply a greater range of strategies.

Table 6.17 Sawmill survey, product line changes 2001-2008

Mill	Size	Product line 2001	Product line 2008	Comment
CI 1	large	dimension lumber	dimension lumber, specialization in pine beetle wood	change towards specialized input
CI 4	large	dimension lumber	dimension lumber, specialization in pine beetle wood	change towards specialized input
OK 3	large	dimension lumber	dimension lumber (40%), commodity (50-55%), J-grade. 75 products	diversification from specialized to flexible focus
OK 4	large	dimension lumber	decking, fencing, siding	diversification from specialized to flexible focus
CO 2	large	green squares	railway ties and timbers	change of specialized focus
SE 1	large	laminate grade, structural wood	large number of products, J-grade, laminate grade, structural wood,	change of flexible focus
CI 5	small	custom moldings, commodity	high-end windows and doors custom planing	change towards higher product value
SE 2	small	dimension lumber	J-grade, dimension lumber	change towards higher product value
SE 3	small	dimension lumber	very diverse, multi-species	diversification from specialized to flexible focus
CO 6	small	own wood	100% custom cut	diversification from specialized to flexible focus
CI 2	small	panelling (100%)	panelling (75%), high end boards (25%)	diversification, extension of product range

Data: fieldwork

6.3.5 Fibre Supply

Of the 22 sawmills in the sample, three are custom cut mills which exclusively process timber provided by their customers (one large and two small mills). Out of the remaining 19 sawmills, 14 have an own tenure (such as tree farm licenses). There is an obvious connection between timber tenure and size; all large mills (except the custom-cut one) have tenure, along with seven small mills. Five mills lack their own timber supply, all of them small. There are clear regional differences with respect to the species used. Most Interior mills rely on an input of SPF, while Fir, hemlock and cedar are the most used species on the Coast. The percentage of the species used in a given mill hardly varies over time, except of slight shifts. Four mills are small specialty cedar mills (two in the Okanagan, two on the Coast

Only four mills use their own logging crews, the others rely on contract logging and market purchases. Since 2001, the share of market purchases has increased, through both inter-firm trade and BCTS. Various government programs have been installed in order to alleviate the access to timber for small mills; however, companies without tenure still lack a stable and consistent timber supply. Even though a higher percentage of the AAC is sold through auctions, it is claimed that firms with tenure can afford to pay higher prices bidding for wood. Uncertainty with respect to the fibre supply is considered one of the main problems of small sawmills.

> *The only way how to help the little guys is to give them some [timber], and let them trade.* (OK 4, small)

> *There were a bunch of reasons why we put the mill here. One of them was the sort yard, because it was a close source of fibre. That's my biggest thing, my customer phones me up for a b-train lumber of cedar, yup, he wants it in 3 weeks, well if I gotta go to the bush and get it, it's going to take the logger longer than 3 weeks to pull out the right log for me, so I can't take the order. That's why we are buying wood as we can and put it in inventory, so when the phone rings I can say: yup, it will be done.* (SE 5, small).

6.4 Attitudes towards Selected Policy Changes

Apart from the issues addressed above, the interviewees expressed their views about a range of topics. Opinions about the three most important topics are summarized in the following. While the duality of small and large mills is reflected in many of the results above, it seems to have little influence on opinion about the following policy changes.

6.4.1 About the 2006 Softwood Lumber Agreement

The SLA is seen as controversial. While few interviewees are happy about the agreement, pragmatic attitudes prevail. Most mill owners and managers in small and large mills alike do not expect a favourable outcome of the trade war. Instead, they wish for stable, consistent and predictable rules to work with as the following quotes demonstrate.

> *One of the things, which you are damned if you do and damned if you don't.* (SE 2, small)

> *…it's an arbitrary derogation against Canadian lumber [...] It's just another penalty on Canadian lumber and its very biased, they haven't done that to Scandinavia or Argentina or any other exporting countries.* (CO 1, large)

> *Suck it up and pay. We didn't have much choice*. (CI 2, small)

> *Which is the lesser of two evils?* (SE 2, small)

> *...as Canadians, let's face it: we have been fighting with Americans over 100 years on lumber and logs and to be so naïve to think that it would end, that was probably a bad thing.* (OK 6, small)

> *For mills like us, we just want to know what the rules are, because when we know what the rules are, we can work around to make it work for us. We can still find a way to reduce log costs, or production costs*. (OK 4, small)

According to some voices, the 2006 SLA will have a positive effect on BC's sawmills by forcing them to become more productive.

> *What they have done for us, because of the SLA, they have made us the best milling outfits in the world. We are the cheapest guys in the world cutting anything, 'cause they forced us to do it. You go down to the States, if you've ever been down there, the mills, they run one shift, they go to the football games on Friday. I've looked at a lot of mills down there and it's a different culture. Up here it's go as fast as you can go, as much production as you can do, as quickly as you can and get as much value as you can get. They forced us to do it. When you look back, someone will say: boy did we ever screw that up, from their point of view, and right now, what do you replace it with? I don't know, so just leave it.* (OK 3, large)

6.4.2 Attitudes to Crises

One result of the survey is that the resilience of sawmills seems to depend strongly on the type of shock they are exposed to. On one hand, the interviewees show considerable optimism regarding market and demand fluctuations. Booms and busts have become routine and sawmills adjusted their strategy accordingly. In such ways, the 2007-09 recession, in spite of its major impact on profits, output and employment is seen as "just another crisis".

You know, we are just at a new dawn of forest industry that is growing. Now we are talking about new products in the bio-energy field, stuff that we never thought of. New engineered products, developing multi-midrise commercial and residential buildings. This is gonna take us into another generation of prosperity in the forest products industry. (Interview with BC Woods)

I have a wish and a plan that when this [crisis] is over, we gonna take this mill and retool and become something else that will survive for another many years. (CO 2, large)

These views are in stark contrast to the perceived vulnerability to institutional change, especially regarding the trade conflict with the US. The response to abrupt institutional shifts, such as tariffs and duties, differs. A recurrent issue expressed in the interviews is the need for certainty; the industry requires a clear and consistent regulation framework in order to plan accordingly for the future. Many mills were hurt by the ongoing trade conflict with the US and by the resulting lack of clear, binding rules. Unexpected policy shifts are another dimension of uncertainty that sawmills have to face, in addition to highly volatile lumber prices and exchange rates. Thus, in a boom and bust industry, consistent and predictable policy seems crucial.

For mills like us, we just want to know what the rules are, because when we know what the rules are, we can work around to make it work for us. We can still find a way to reduce log costs, or production costs. (OK 4, small)

6.4.3 About Appurtenancy

In 2003, the BC government abolished appurtenancy. Until then trees had to be processed in the region where they were harvested. This policy change is seen differentiated by the interviewees. Some of them, mainly the managers of large mills, welcome the market-driven consolidation process, which they consider inevitable, and appreciate the resulting efficiency gains, such as the fact that firms now can move wood freely between different operations.

...the BC liberal government got rid of appurtenancy and I think it was absolutely the right thing to do. With appurtenancy, it was just a huge impediment to the much-required consolidation that is necessary if you want to be competitive. (OK 1, large)

That's a good thing that they got rid of it. (CI 4, large)

It had to happen. The mills are closed, look what's happened to the industry, it's disintegrated. What are you going to say? This mill has to cut those logs when it doesn't make sense? It disappeared out of necessity. (CO 1, large)

Good move. It was a dumb policy that the timber supply was tied to a mill, even though the mill had never hope to make money. (CO 3, large)

Some managers on the other hand emphasize the problems the new policy could cause for sawmill towns. Over a long time, the forest industry has had close ties to the communities. Workers and owners or managers often live in the same small town and have private contacts. While the social contract has eroded and the formal commitment of the industry towards resource communities has declined, the withdrawal of many multinational firms from BC has resulted in an increasing share of domestically owned firms. Many sawmill managers and owners have strong ties to their communities.

Mixed feelings. On the one hand, I understand why they got rid of it. I understand the reasoning behind it, because from a business point of view it is not a bad thing, the economics of it [...] So you end up with mills shutting down cause they sold their quota and then small communities get hammered, I understand that part, it's a sad part. But does it make sense to have two of the mills running and having them both lose money, when with just one at least you can salvage something? I think that you are not going to stop evolution in the industry. (SE 1, large)

I don't like that. They should never have done that. It's killing small towns in BC. We used to have a viable industry and that's why a lot of people moved to these towns [...] Poor government representation for people living in small towns. (OK 4, small)

It is a dilemma for the industry that restructuring results in the weakening of the periphery. While most of the new, value added mills open in urban centres, sawmills shut down across BC, eroding the economic base for many forest communities.

6.4.4 About Community Forests

The BC government introduced Community Forests in 1997 as an opportunity for communities to gain a degree of control over their surrounding forests. Many of the interviewed sawmills buy timber from community forests. Especially small mills appreciate the fact that in contrast to a timber tenure they are able to buy the desired quantity and grade of wood.

> *I really look towards the community forests […] because I am able to pay a premium over what the big mills are able to pay […] [Name of community forest] is a great match for our business […] They don't have money to implement a mill, just for start up costs, it's a community forest, they don't have hundreds of thousands of dollars. It's a great match for me, they bring me the logs, I have a log supply, I am able to cut it for them, process it, finish it, sell it for their markets as well. It just means more jobs for me because I am matched to a wood basket.* (SE 5, small)

Other mills point out the opportunity for community involvement.

> *...always a good idea. It gets more involvement from the community, provides us with an excellent way to build relationships with the community.* (CI 4, large)

There are, however, some concerns about whether community forests are managed efficiently and the uncertainty generated by frequent policy changes.

> *They were never set up in an efficient way* (CI 5, small)

> *They are going to have a new mayor in there, everything changes, priority changes, it's not like a company looking after a TFL.* (CI 2, small)

> *They're good, they're fine. I mean, if they can make money…* (OK 3, large)

> *[Name of community Forest] is a good example of how nothing happens. We have a mill that has no wood. We built the mill on a bid proposal program that there would be more licenses available. We had a 6-year license when we built the mill, when the 6 years ran out we got it extended a few years, then time ran out, the volume ran out, there were no new timber sales to sustain the operation. And the natives got most of the wood. How many years has the mill been down? It's a beautiful new mill.* (CI 2, small)

6.4.5 About Bio-energy/ Use of Waste Wood

BC's bio-energy strategy aims to reduce greenhouse gas emissions and promote electricity self-sufficiency, using pine beetle killed timber and wood waste for generating renewable energy. New bio energy tenures that provide access to waste wood were introduced in the 2008 Forest Act. In general, the initiative is appreciated by the interviewees, both in large and small mills.

> *It's great. We have such a great supply of it from our mills and it opens up doors for me as well right. Now we are taking my waste and making electricity, that's awesome. You know we are taking a by-product that I have a hard time getting rid of and we are utilizing it, it's awesome.* (SE 5, small)

Most interviewees agree that bio-energy should not be subsidized but market-driven and include the full indirect cost. However, at the present time they argue that wood is too expensive for using it just for bio-fuel.

> *There is a horrendous amount of fuel out there in the bush, to find an economical solution to do something with it, that's the problem*. (CI 2, small)

> *...well, it is a fossil fuel, carbon in the atmosphere. And it's expensive, to go and cut down trees, just to burn, unless you have waste.* (CO 1, large)

> *So unless energy [price] goes up substantially, either it's got to be subsidized or you are going to create a situation where both the bio-energy and the pulp sector competing for the same fibre [...] The most economic way to do it right now is to take the by-product from the sawmills.* (Interview with COFI, Kelowna office)

> *I think it's a wonderful idea and it's going to happen. But right now, it's just not economical at all and we have proved it. We have [name of the power plant], which is a 300 million dollar plant, fully depreciated, they don't own any money on it, they cannot afford right now to bring that fuel in from the bush [...] So we have to figure out how to get the fibre out of the bush and back here for cheap, otherwise I don't see it happening [...] I mean a lot of our waste is there. What you are seeing in the bush is all those call piles that we aren't bringing to the sawmills cause it doesn't make a saw log. There is some astronomical amount of waste going on out there but how do you get it from there to here, where your hauling distance is a function*. (CI 4, large)

...there is a lot of fibre left out in the woods, you know, can we utilize that, but economics will drive that. What can you make out of it, what will it cost to get there and turn it in to something, if somebody can make a buck out of it at the end of the day then something will happen. (OK 1, large)

6.5 Conclusion

BC's sawmill landscape is diverse and differentiated and the surviving mills show a variety of responses to the 2007 financial crisis. While most surviving mills downsized and rationalized, some mills increased employment and output against the trend for a variety of reasons. The survey confirms the existence of a dual industry structure (chapter 4), although not in terms of a strict size dichotomy. The industry is increasingly fragmented with respect to ownership, production, and strategic focus. The dichotomy between Coast and Interior is still evident and reflected by differences in fibre use, by the exposure to the pine beetle and with respect to export markets. In many other respects the interviewed sawmills exhibit more variation *within* a region than *across* regions and there are large differences between mills regarding input, products and export markets in the same region.

At the corporate level, while many large forest corporations downsized, withdrew from the province, or disappeared (such as MB), large, family-owned companies performed better. Those large family-owned firms are in many aspects the most dynamic forest companies and will likely play a bigger role in the future. They might not operate on the same scale as the giants such as Canfor, West Fraser or Western Forest Products, but they own multiple production sites, have considerable resources, knowledge of products and markets and seem to commit to their employees and the province.

7: CONCLUSION

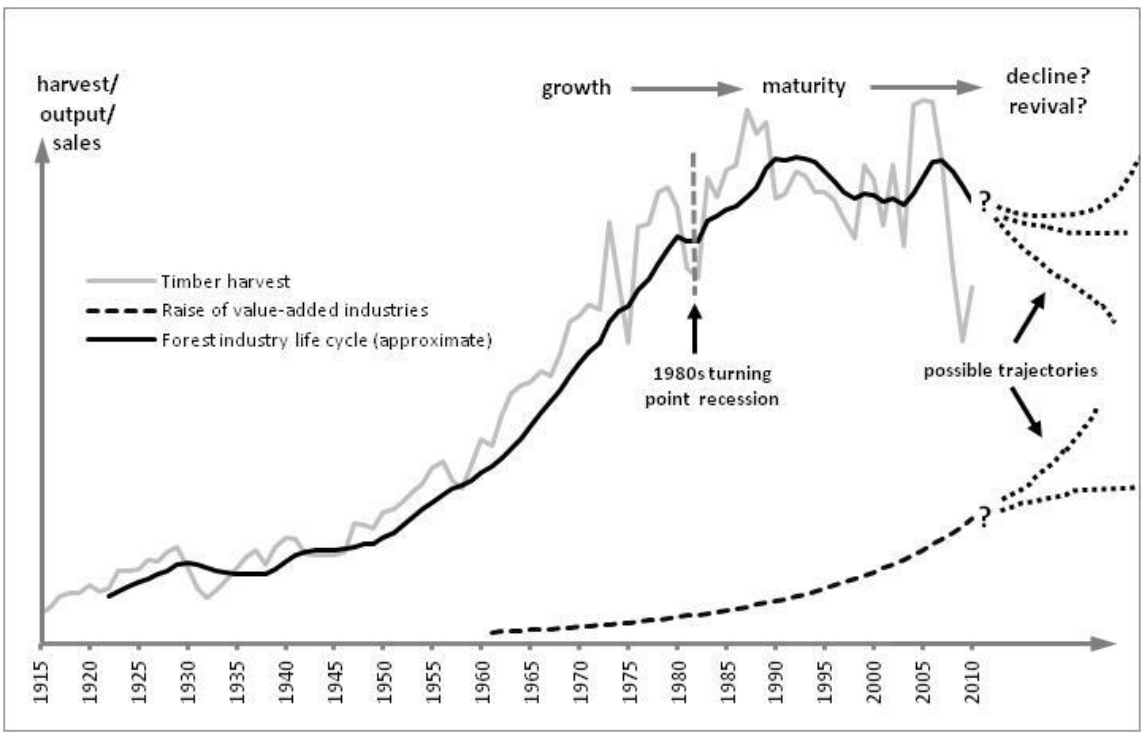
This thesis has explored the restructuring of BC's forest industries over the last four decades from the theoretical perspective of evolutionary approaches to economic geography and resource peripheries. The results have demonstrated that crises and recessions play a crucial, if ambiguous, role for economic evolution. While they stimulate selection and change, they also provide incentives for short-term thinking and restrain the resources necessary for undertaking new projects.

Restructuring has many facets and multiple causes; the reasons and factors that initiate the restructuring processes are differentiated and involve both economic and non-economic factors, powerful cumulative tendencies, and powerful threats to these tendencies. In BC's forest economy, restructuring has evolved in terms of a complex, interdependent set of economic and institutional factors, such as export demand, exchange rates, the falldown effect, the mountain pine beetle, production technology, Aboriginal land claims, environmental conflicts, and the trade war with the US. The special case of resource peripheries and economies is illustrated by the strong role of resource politics and other institutional factors that powerfully influence market forces. The chosen framework of BC's forest economy as a local model, which assigns an important role to those non-economic factors, has proven extremely useful to grasp this multitude of "restructuring initiators".

In similar ways, the outcomes of recession and restructuring are differentiated, although clear aggregate trends are evident, such as the downsizing in terms of employment, the consolidation and de-internationalization of the industry, and the shift of economic activity from the Coast to the Interior. However, at a smaller scale restructuring yields ambiguous results and trends are difficult to identify. Growing and dynamic segments exist alongside declining sub-industries. Some companies grow and expand while others are taken over and disappear. Sawmills close down, survive, or are newly constructed. Therefore, it is hard to make statements referring to "the" forest industry as it is divided along many lines: different sub-industries, large versus small firms, or Coastal versus Interior companies.

The life cycle dynamics of BC's forest industry – approximated by timber harvest – follows a cyclical trajectory (figure 7.1): an extended period of rapid, relatively smooth growth followed by maturity. The turning point between growth and maturity is marked by the 1980s recession. Among the many ambiguous outcomes of restructuring, two major patterns are notable and illustrated by the graph. First, the evolution of BC's forest economy is associated with increasing volatility in an economic but likewise in an institutional sense. Second, a dual industry structure has emerged and seems to persist. In addition, the RILCM raises the question about resilience or the future of BC's forest industries. In the following sections 7.1 and 7.2 these trends, volatility and duality, are discussed. Section 7.3 debates the effects of restructuring on resilience. Section 7.4 reflects on EEG and the RILCM. Section 7.5 gives directions for further research.

Figure 7.1 Resource industry life cycle dynamics of BC's forest industry

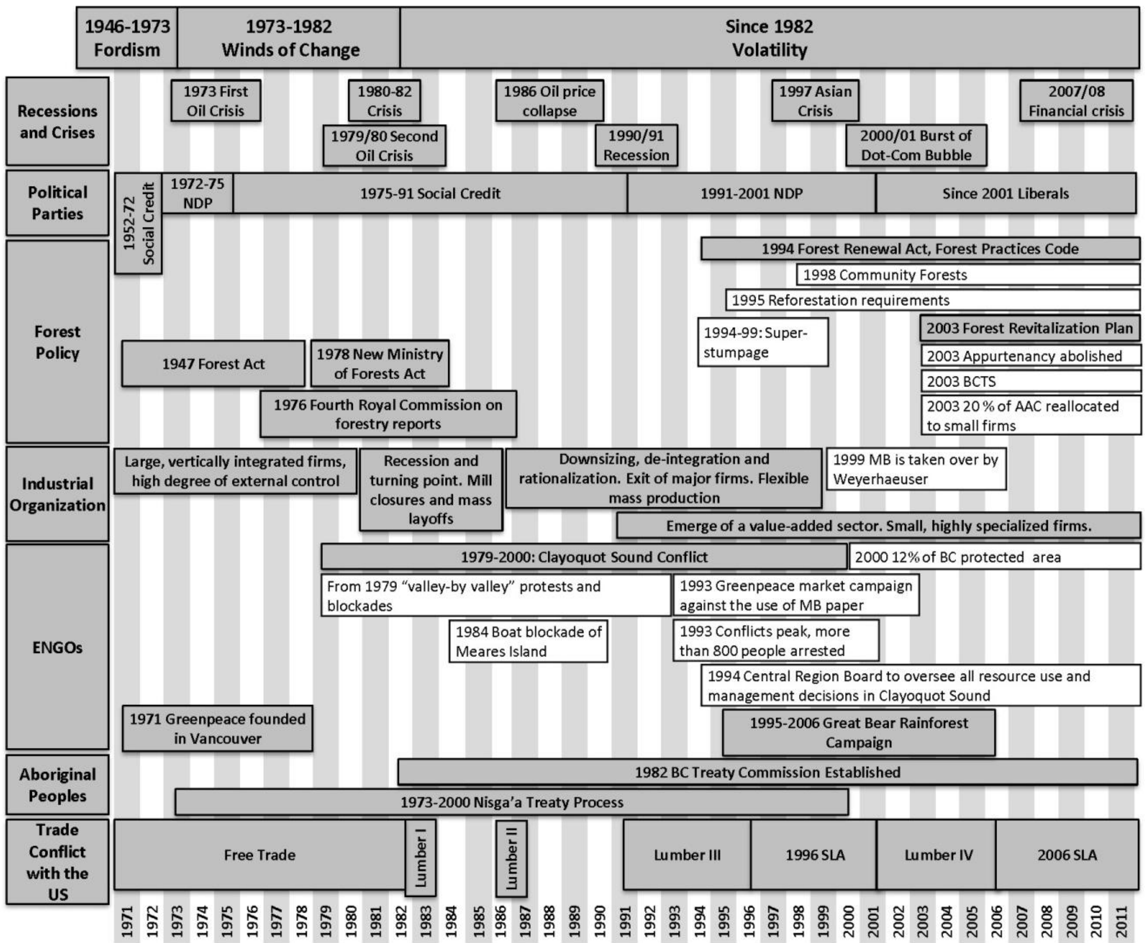


Data: Timber harvest: BCMoF, annual reports.

7.1 Volatility

From the 1970s, the stability of the Fordist regime was replaced by a series of booms and busts that is discernible in virtually all industry variables. While these fluctuations are mainly driven by export demand, especially by the US housing market, other factors, such as the falldown effect, exchange rates, or the MPB play a role as well. The booms and busts, however, did not immediately lead to the restructuring of the industry. Instead, the profound institutional changes that took place since the 1970s (figure 7.2) suggest that the restructuring of BC's forest industry is rooted in a prolonged structural crisis of adjustment between the prevailing Fordist production system and an evolving institutional environment.

Figure 7.2 BC, major institutional changes 1971-2011



Source: author's graphical representation

The figure reflects three major institutional trends. First, the number of actors concerned about and involved with BC's forests increased considerably. The Fordist "wood exploitation axis" was replaced by a diverse set of stakeholders, such as the industry, government, ENGOs, Aboriginal peoples, and local communities. Second, views and attitudes about BC's forests have changed. During Fordism, the use of the forests was virtually limited to their industrial value, mere timber supply. The emergence of additional actors and the subsequent "*remapping*" (Hayter 2004b) led to various conflicts about the functions and values of BC's forests. Today, non-industrial values such as aspects of biodiversity, recreation, carbon sequestration, religion, and spirituality are increasingly important alongside industrial profits, employment, wages, and tax revenues. As a consequence, forest policy itself has become more volatile and has seen much experimentation over the last decades, such as the emphasis of environmental values and high stumpage rates during the 1990s, the attempts to de-regulate in 2003, and the bio-energy initiatives starting from 2008. Third, the free trade regime that had guaranteed unlimited access to BC's major export market for decades was replaced by protectionism and dispute.

The structural crisis of adjustment in BC's forest economy was triggered by institutional evolution. This result is a major difference to the predictions of the TEP model in which innovations within the techno-economic sphere spur evolution and change, while the inert socio-institutional sphere lags behind. Evidence indicates, however, that in the case of BC, evolution is driven by institutional change. While the large, vertically integrated Fordist corporations managed to adjust to demand fluctuations to some extent, they were unable to cope with a volatile institutional environment. Sudden and unexpected changes with respect to environmental regulations, timber tenure, or the regime of foreign trade add an additional layer of uncertainty to the already unstable business environment. Forest corporations have a range of strategies at hand in order to react to demand fluctuations, such as rationalization and consolidation, temporary layoffs and closures, changes of the product line, or the shift to new markets. Institutional conflicts, however, such as Aboriginal land claims or foreign trade disputes, are beyond the scope of a single mill or firm, as they cannot be solved at the corporate level.

Booms and busts have become routine for BC's forest industry. The case of Canfor has demonstrated that some companies managed to survive by adjusting their corporate strategies, but the volatile environment and the resulting uncertainty have put the industry under immense pressure. While volatility stimulates selection and change, it simultaneously imposes severe limits to long-run thinking and strategic investment. In BC's forest economy a boom and bust environment has both reinforced and modified path-dependent behaviour, but there is little sign of lock-in into a new, *stable* trajectory in the mainstream commodity industries. A value added wood industry populated by small firms has emerged, but it has experienced high turnover rates in entrants and exits and is largely concentrated in Metro Vancouver.

7.2 Duality

In terms of the industry life cycle model, BC's forest industry shifted from growth to maturity over the last three decades. The 1980s recession as turning point marks the transition between the two stages. Growth rates have levelled off or declined in the traditionally important commodity industries. The ILCM predicts the eventual decline of a mature industry. Alternatively, a new phase of growth can begin, based on process innovations and new products. The emergence of a dual industry structure, which is observed in BC's forest industry, is not in line with the ILCM predictions. Since the 1980s, a highly dynamic value added sector has emerged alongside the commodity sector. Yet it would be misleading to distinguish between an "old" commodity sector and a "new" value added sector as the former has also adjusted and changed in many ways. Examples are the construction of super-sawmills specialized in dead beetle wood or the shift towards the generation of green energy by means of co-generation and wood pellet mills. In fact, the duality of flexible mass production and flexible specialization has evolved and continues to exist.

Those two sectors constitute two industrial paradigms or two models of "best practice". They represent different strategies of adjustment to a changing environment. The two paradigms are not mutually exclusive; rather they are interdependent (table 7.1). There are at least three reasons for a persisting duality within BC's forest industries (Woodbridge Associates 2009, 60): A combination of large volume commodity products and a growing percentage of value added products are seen as economically viable. The peripheral location of BC and the distance to its major markets requires a business model that at least in parts relies on large scale, low unit cost production. Trees yield a large volume of medium and lower grade wood that is well suited for commodity products, but not necessarily for value added production. Thus, the coexistence of interdependent small and large firms in the future is possible and likely.

Table 7.1 Two segments, complements and contradictions

		Flexible mass production	Flexible specialization
Contradiction, competition	Timber supply	Reliance on stable, long-term timber supply (tenure or similar)	Fluctuating demand for small quantities of timber; preference for market purchases or auctions
	Labour	High wages due to high productivity and low unit costs; good benefits and working conditions due to the union's colllective agreement or similar arrangements.	Mills tend to be non-unionized and pay lower wages and less benefits; higher job turnover due to higher closure rates
Complement, possible cooperation	Timber quality	Can use different grades of wood, from low to high quality; different species; can specialize in processing dead beetle wood	Preference for high grades and selected species
	Markets	Focused on export markets; would benefit from free-trade	Focused on local and domestic markets; increasing efforts to develop export markets; would benefit from free-trade
	Location	Dispersed across BC; proximity to fibre-base is essential	Concentrated in urban centres; agglomeration economies and proximity to customers are essential

Source: author's representation

This dual industry structure has important geographic implications. Very roughly, the location factors for BC's forest industries can be understood in a Weberian sense. There are location factors pulling towards the resource site, such as land cost and especially the high transport costs for raw logs. Commodity wood products such as dimension lumber, pulp, and newsprint constitute typical weight loss materials. On the other hand, there are factors pushing towards a location in the urban core. Those factors include the proximity to customers and potential business partners, transport hubs such as harbours and railways, business services, a pool of specialized workers, and other agglomeration advantages. Regarding the forest industries, the more value is added by an industry, the higher is its concentration in the urban core. Logging camps, large sawmills, large board mills, and pulp and paper mills tend to locate close to the fibre-base due to high transport costs and (previously) appurtenancy; therefore their spatial pattern is disperse. Plants in sub-industries further down the value chain, such as small specialty sawmills and the value added wood and paper industries are located close to urban centres, mainly in the Lower Mainland, but to an increasing extent also in a few other cities, such as Kelowna. This duality bears important implications for the further development of BC's forest sector. As the industry becomes more value added, more plants will locate in urban regions. Thus, while the province as a whole might benefit from the shift towards more value added activities, this also implies a (relative) shift of economic activity from the periphery to the core. Consolidation of sawmills and pulp mills will result in further employment reduction and a decreased number of large establishments that can exploit economies of scale, such as the super-sawmills that emerged in the early 2000s. This trend is likely to have negative socio-economic impacts in remote, forest dependent regions (Lazar 2007).

7.3 Resilience

How do resource regions cope with the cyclonic forces of crises, institutional conflicts, recession, and restructuring? How resilient is a region? The concept of regional resilience (Bristow 2010; Christopherson et al. 2010; Pike et al. 2010; Simmie and Martin 2010) is ambiguous and somewhat fuzzy, allowing for different interpretations in different regional contexts. It is hard to measure resilience and therefore not always clear how it can be achieved in a particular region. Taking the view that regions are intrinsically diverse entities with evolutionary and context-specific development trajectories (Hayter 2004c), resilience depends on the development path of the region and means different things in different locations. Resilience in one place could mean economic diversification, while somewhere else it might stand for the survival of important key industries.

It remains ambiguous whether resource peripheries are more or less resilient to external shocks than core regions. In some sense, they are more vulnerable as they tend to be mono-structured and less diversified with respect to their economic and institutional structure. Furthermore, resource peripheries are subject to manifold interests and strong external forces, located in both the national and global economic core, which in many cases leads to conflicts with internal governance. On the other hand, many resources, particularly wood, can be sustainably used for a wide range of products as well as for energy generation. In such ways, the resource constitutes an abundant and renewable economic base, which does not erode as easily as in the case of a "footloose" industry.

While it is somewhat difficult to define resilience for regions and communities, for an industry it simply means the ability to survive. In these terms, the recent decades of recession and restructuring have had an ambiguous effect on BC's forest industries. On the one hand, many sub-segments, as well as the industry as a whole, downsized; firms went out of business, workers were laid off and mills closed. On the other hand, the crisis stimulated growth in selected segments, some companies expanded and new mills were constructed. Among firms and plants, outcomes are highly differentiated; minor differences in strategic focus, industrial organization, location, or export markets can make the difference between survival and closure. Companies with a strong Coastal base, such as MacMillan Bloedel, were more affected by the crisis, regardless of their strategy. Thus, resilience is highly differentiated with respect to production sites, firms and sub-industries.

As for BC's forest industry as a whole, it has been referred to as "sunset industry", a mature, declining, and dying industry. From its peak in 1979 until 2009, the industry downsized from 96,000 direct employees to less than 45,000; every second job was lost. The workforce is aging and lacking of apprentices, as most young people do not see a future in working for the forest industries. In the future timber supply will decrease because of the MPB infestation. While the AAC before the beetle uplift was 37.2 million m^3, the BC Ministry of Forest estimated that within the next 25-30 years, it would decrease to 20 to 25 million m^3. In comparison, the AAC in 2006 was 54.6 million m^3 while actual harvest was 45.9 million m^3 (BCMoF 2007b). The US market, the main source for export demand, will likely remain weak for a long time and even if it eventually recovers a solution of the softwood lumber dispute on favourable terms for Canada is extremely unlikely. Returns on capital have been low for many years and therefore resources to undertake new projects are difficult to obtain. Mill closures throughout the province have stripped many forest communities of their economic base. In general, the industry has lost its role as "provider" and "job machine" for rural BC, which also resulted in a loss of political leverage.

Despite those facts, the perspectives for the industry are not entirely dire. Some segments are growing and highly dynamic, especially the value added industries, which today account for almost a third of total employment. Although the network of sawmills has been pruned, BC's forest industry is still present across the whole province and some of the largest, most modern, and most productive sawmills worldwide are located in the province. World demand for wood products is growing (Woodbridge Associates 2009, 17) and recent policy initiatives to develop BC's existing links into a "Gateway to Asia" might provide opportunities for the stepwise substitution of US-bound exports with shipments to the dynamic economies of China and India. In similar ways, the formerly existing lumber trade linkages with Japan might be revived. Furthermore, Canada's population is growing, increasing domestic demand for wood and paper products.

In times of increasing environmental awareness and "peak oil", BC's forests provide an ample source of renewable energy if managed in a sustainable way. An emerging "*green paradigm*" (Hayter 2008a) will likely increase the demand for sustainable forest products and green energy. In the past, changing attitudes towards BC's forests and the environment in general caused much turmoil and made life hard for the industry. In a somewhat paradoxical way, the same trend could initiate a "new dawn" for BC's forest industry in the future.

7.4 The RILCM and Evolutionary Economic Geography

This thesis conceptualized the evolution of BC's forest industries within the framework of the RILCM that integrates the ILCM with the resource cycle thesis and incorporates the effects of crises and recessions. The RILCM served to appreciate the distinctive nature of resource industry trajectories and the implications of volatility for industrial evolution. This model was applied particularly to understand the so-called plateau stage that in the BC forest economy has lasted for 30 years.

The RILCM as a modified and localized version of the ILCM is highly distinctive and it takes into account the association of plateau effects with the paradigmatic turning point of the 1980s recession and the importance of economic as well as non-economic factors for BC's forest industry. Thus, the results of this thesis show that the RILCM-framework is useful and necessary for getting insight into the evolutionary development of BC's forest industry and some theoretical insights can be derived from the use of this model.

First, crises and recessions play a crucial role in industrial evolution. Thus, they should be neither assumed away, such as in the "basic" ILCM model, nor treated as random fluctuations, such as in the business cycle literature. The connections between crises and industrial development are deep-rooted and complex. The results of this thesis suggest that crises have (at least) two dimensions: A quantitative dimension that is measurable as amplitude of selected variables (such as GDP, timber harvest etc.) and a qualitative dimension that is reflected in the effects that a crisis has on industrial evolution. In such ways, a recession can either be a major turning point or show no lasting effect on the development path of an industry. The relation between those two dimensions is complex, such for instance a more severe recession in terms of the amplitude does not necessarily imply a stronger effect on industrial evolution.

Second, institutions matter for industrial evolution. The results suggest that a turning point crisis emerges as result of a complex interplay of quantitative and qualitative factors. Likely, the role of institutions is especially strong in resource industries; they are highly dependent on regulation and policies because natural resources always involve both industrial and non-industrial values that are subject to mapping and re-mapping.

Third, this thesis found that volatility increased as the forest industry approached maturity. Thus, the plateau phase is by no means flat, but characterized by a series of booms and busts. Whether or not this is a unique feature of BC's forest economy, volatility and the overall pattern of recessions and crises might be important for industrial evolution. In this context, the question emerges about how economic crises influence path dependent behaviour. While path dependence relies on the value of past experience, this experience is questioned by a recession and even more by a sequence of booms and busts. Whether a path is ”right” or “wrong” can in most cases not be predicted, but only be seen after the crisis, as the examples of Canfor and MB demonstrate.

Fourth, the findings suggest that each crisis is a unique event in space and time and a complex and interwoven fabric of “economic” (such as supply, demand, and prices) and “institutional” forces (such as habits, rules, and regulations). Crises are highly ambiguous catalysts for evolutionary change, selection mechanisms, and agents of creative destruction, initiating shakeouts along with entries and new growth. They signal the need for change, encourage change, discourage change, reward, and punish.

In general, crises have been a much-neglected topic in EEG and this thesis calls for a stronger focus on recession and crisis in geographic research. Geography has both the instruments and the perspective to approach crises and understand them in their uniqueness and complexity, as spatial, scale-dependent, and path-dependent phenomena. Local models allow for a focus on institutions and qualitative factors while not losing track of “market forces”. The combination of quantitative and qualitative research methods makes it possible to capture the reasons and outcomes of a crisis both in detail and as a whole. Crises and recessions are fascinating research object and EEG should not ignore them.

7.5 Directions for Further Research

The results of this thesis raise a number of questions about the relationship between recessions and restructuring. Both the TEP and the ILC model – the starting points of the conceptual framework for this thesis – are macro level models that provide good general insight into aggregate processes. Although their explanatory power in a regional and resource economy context is limited, both models can be easily modified to suit that purpose.

In order to adjust the TEP framework for the analysis of crises and restructuring at the micro level, some concepts need to be further specified. In such ways, Freeman's and Perez' model lacks of clear definitions of the techno-economic and socio-institutional spheres and how they are separated. In similar ways, clarification is needed about how "matching" and "mismatching" works at different scales.

Furthermore, it would be worthwhile to explore whether a role for institutions as driving forces are limited to resource industries and peripheries, or even to the special case of BC, or whether this finding can be generalized to restructuring processes in core regions and other industries.

Industry life cycle research has paid little attention to resource industries, although Clapp's (1998) resource cycle model suggests a similar dynamics. The incorporation of resource dynamics into the ILCM could give insight into the long-term trajectories of resource regions and their implications. In similar ways, the ILCM does not incorporate a role for crises and recessions and neither for institutions; integrating those important features into the model would certainly make it more useful for economic geography.

The evolutionary project in geography is young and promising with much work to be expected over the next years. This work has contributed to this emerging branch of research, shedding light on the neglected topics of crises, recessions and resource peripheries

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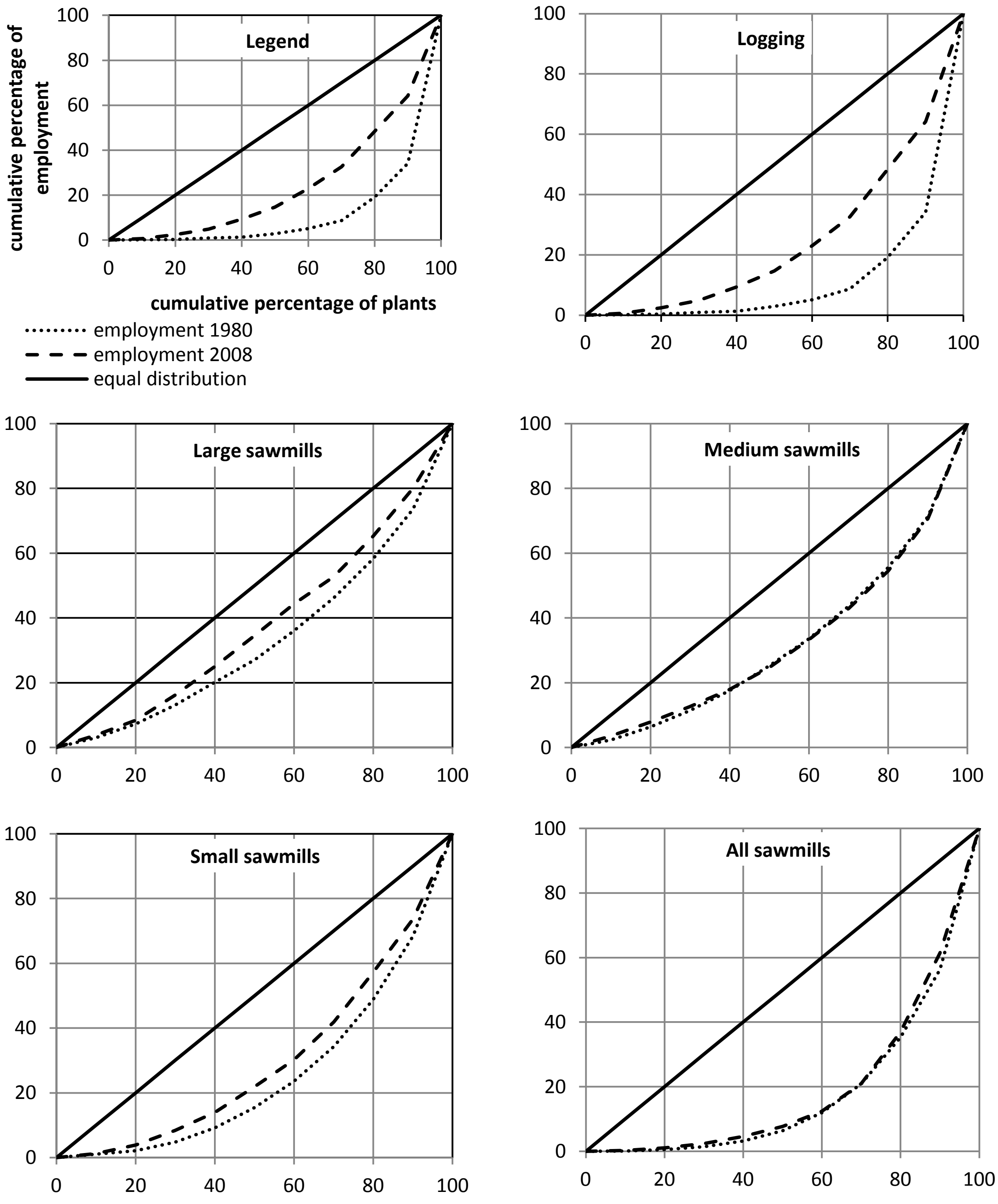
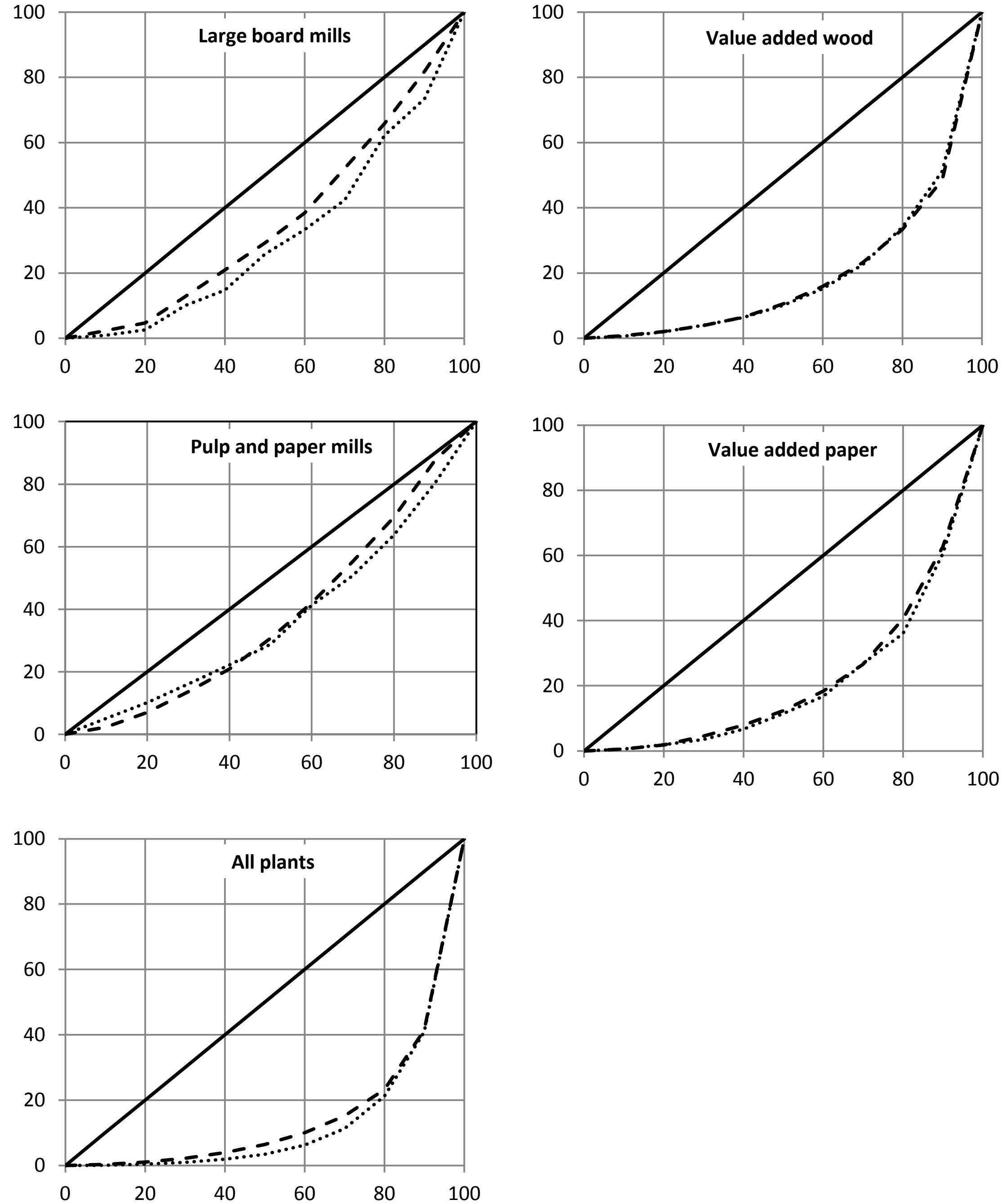
APPENDICES

Appendix A – Lorenz Curves

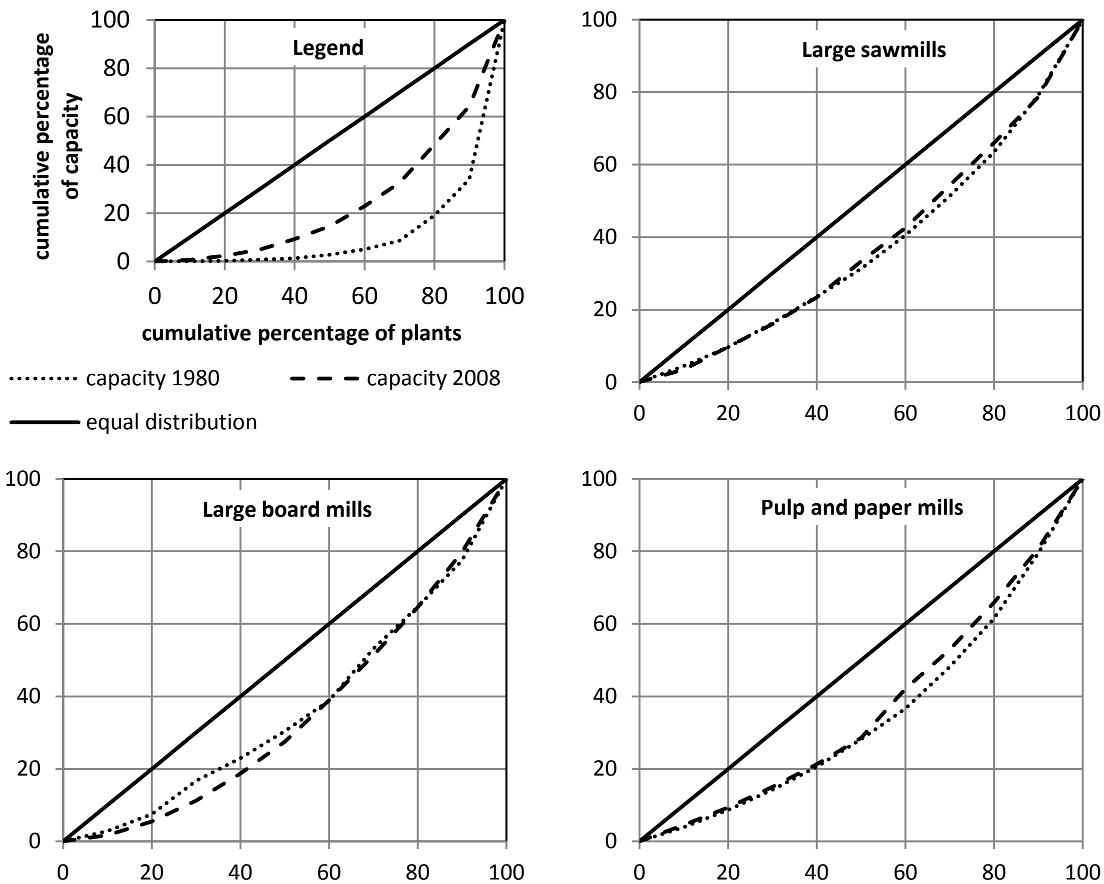
Figure A.1 Plant population analysis, Lorenz curves for employment 1980 and 2008





Data: industrial directories

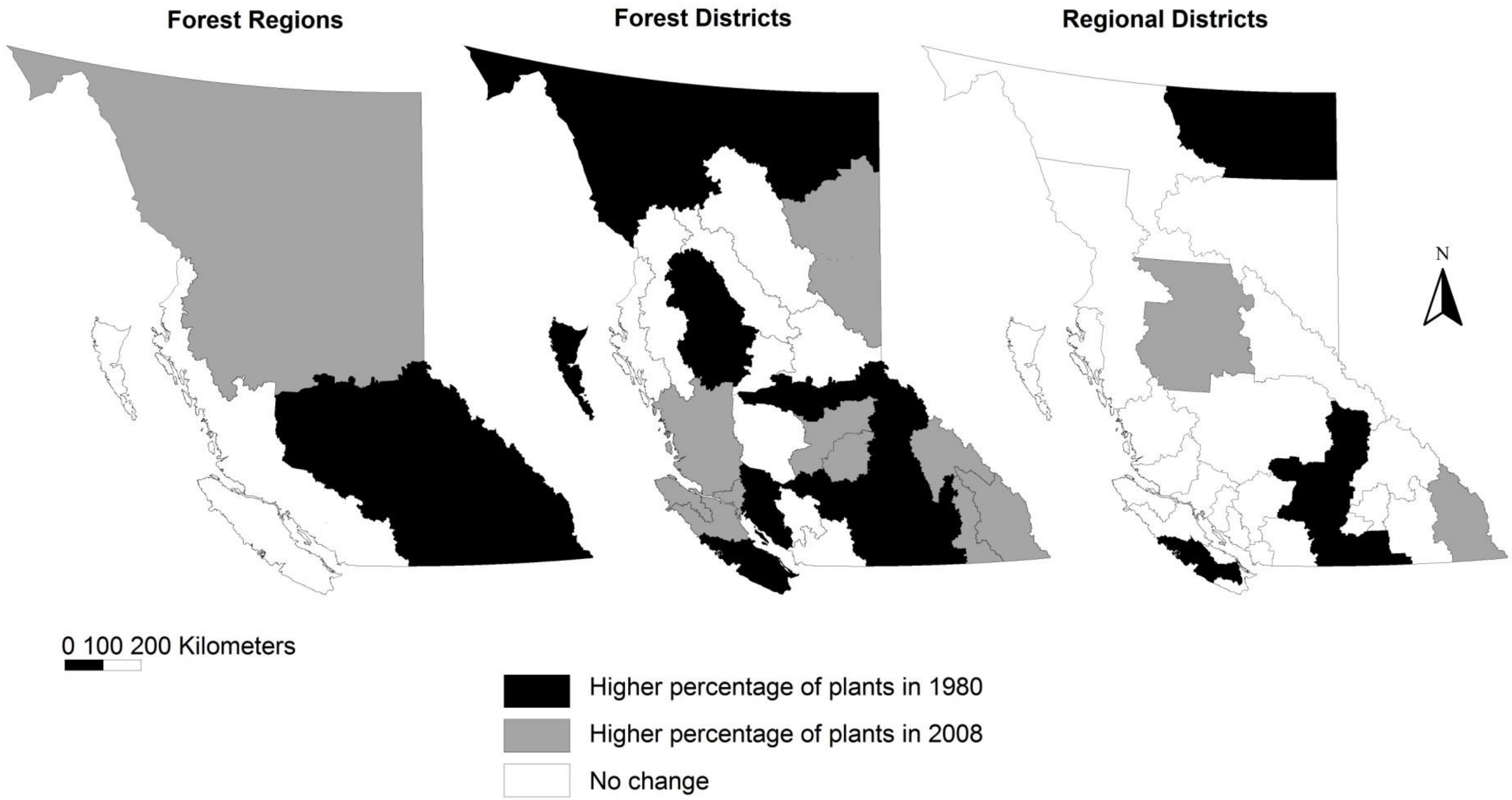
Figure A.2 Plant population analysis, Lorenz curves for capacity 1980 and 2008



Data: industrial directories

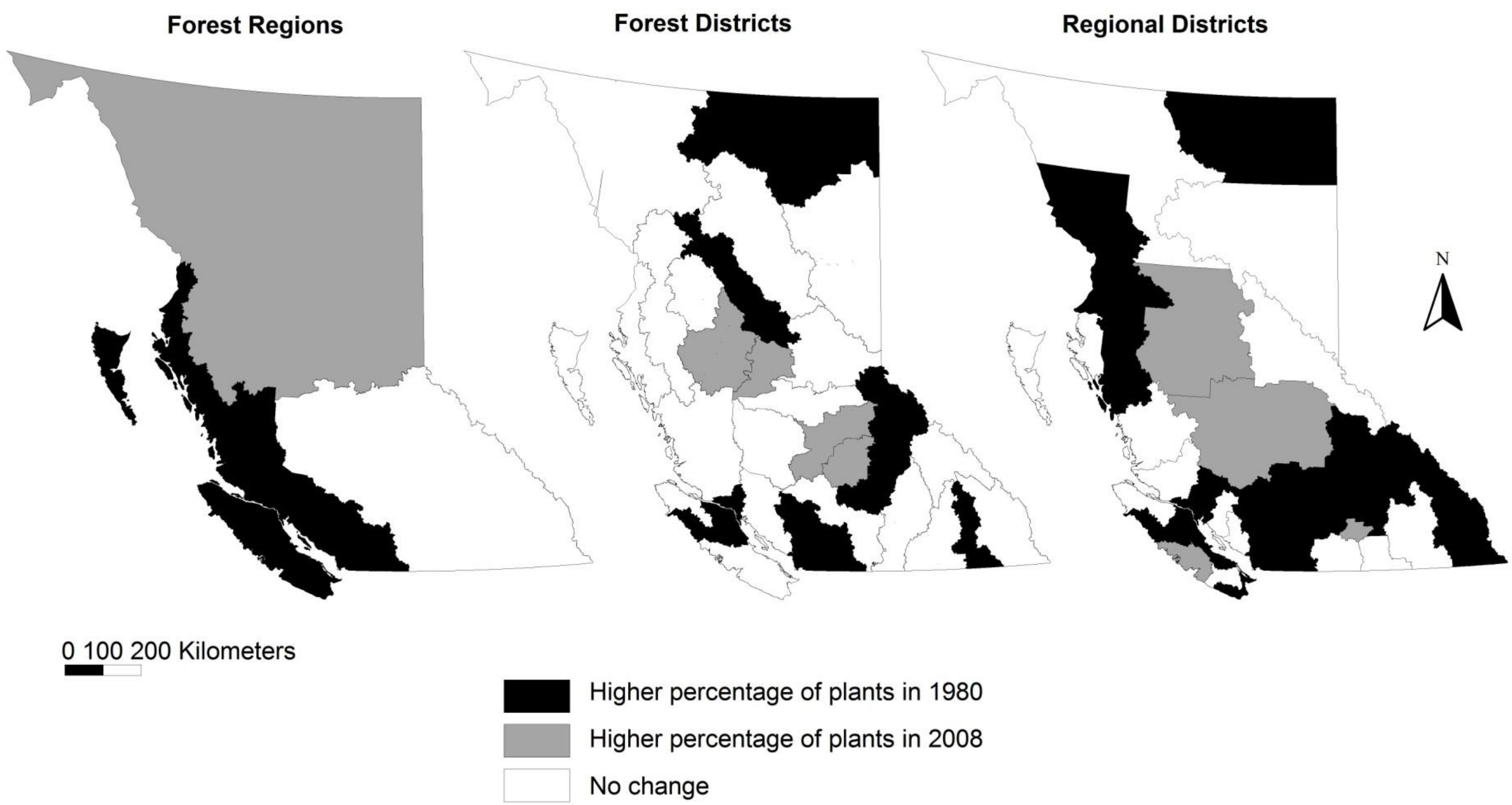
Appendix B – Andresen (2009) Test Results

Figure B1 Andresen (2009) test results, logging



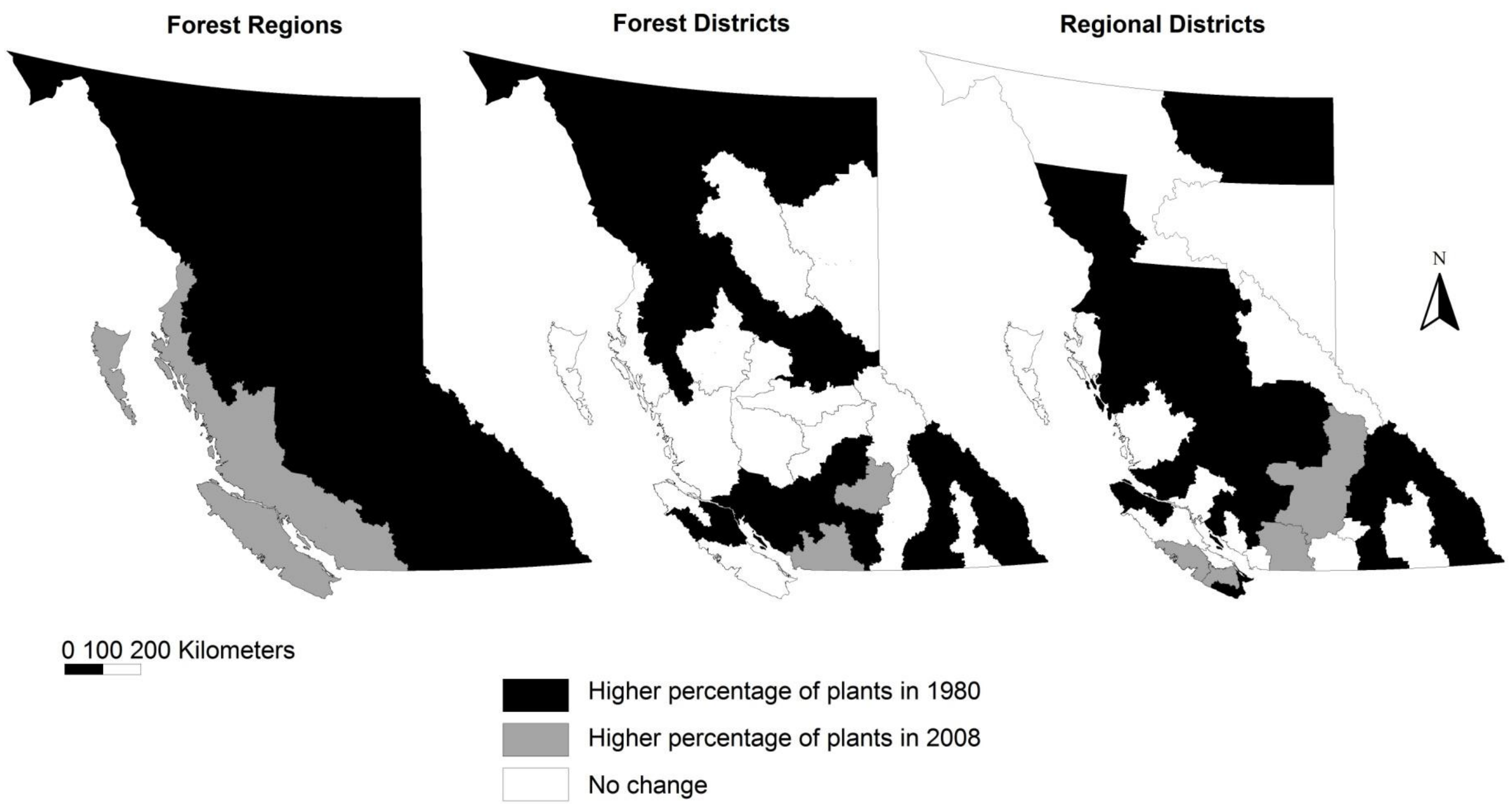
Data: industrial directories

Figure B2 Andresen (2009) test results, large sawmills



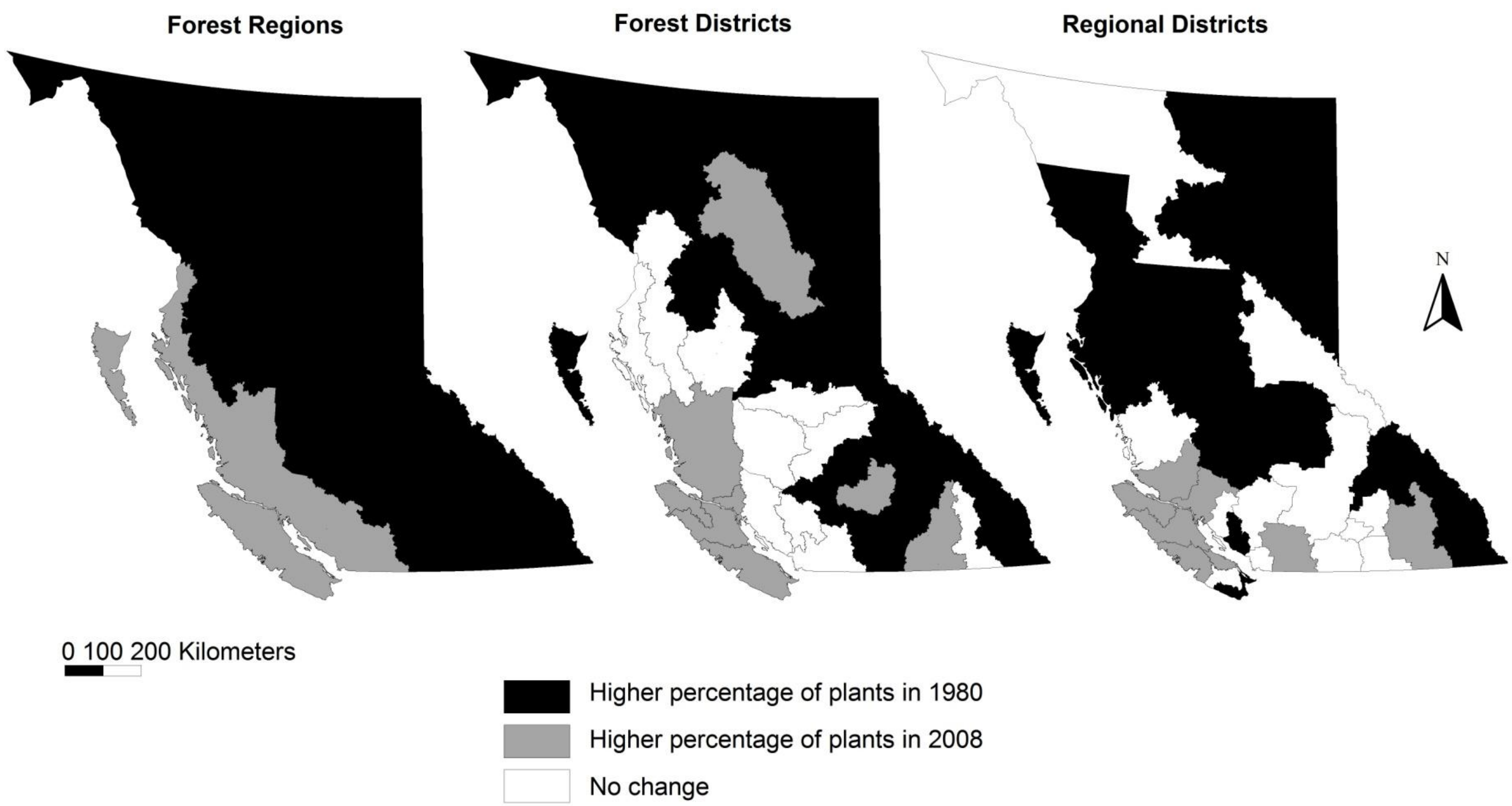
Data: industrial directories

Figure B3 Andresen (2009) test results, medium sawmills



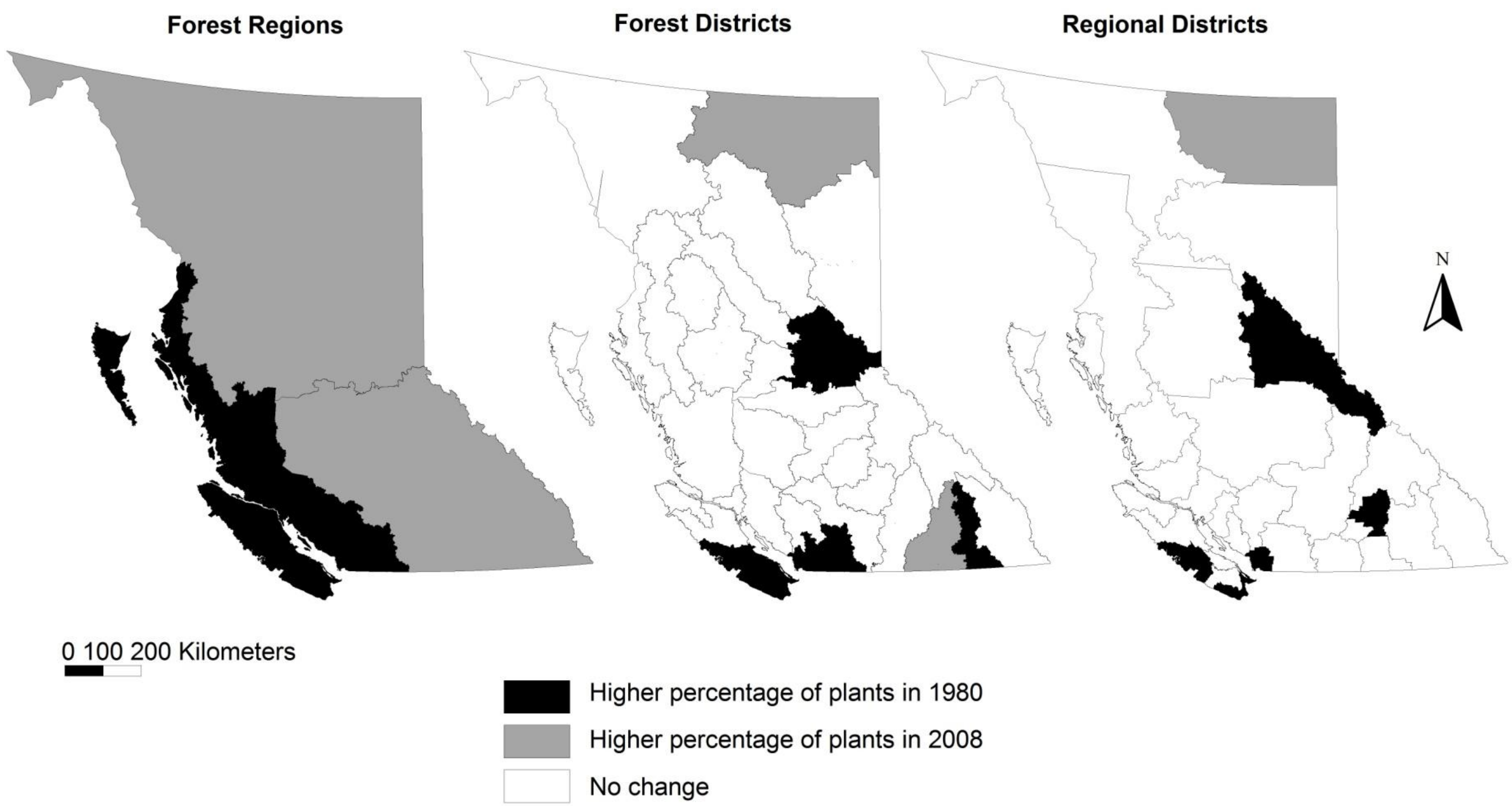
Data: industrial directories

Figure B4 Andresen (2009) test results, small sawmills



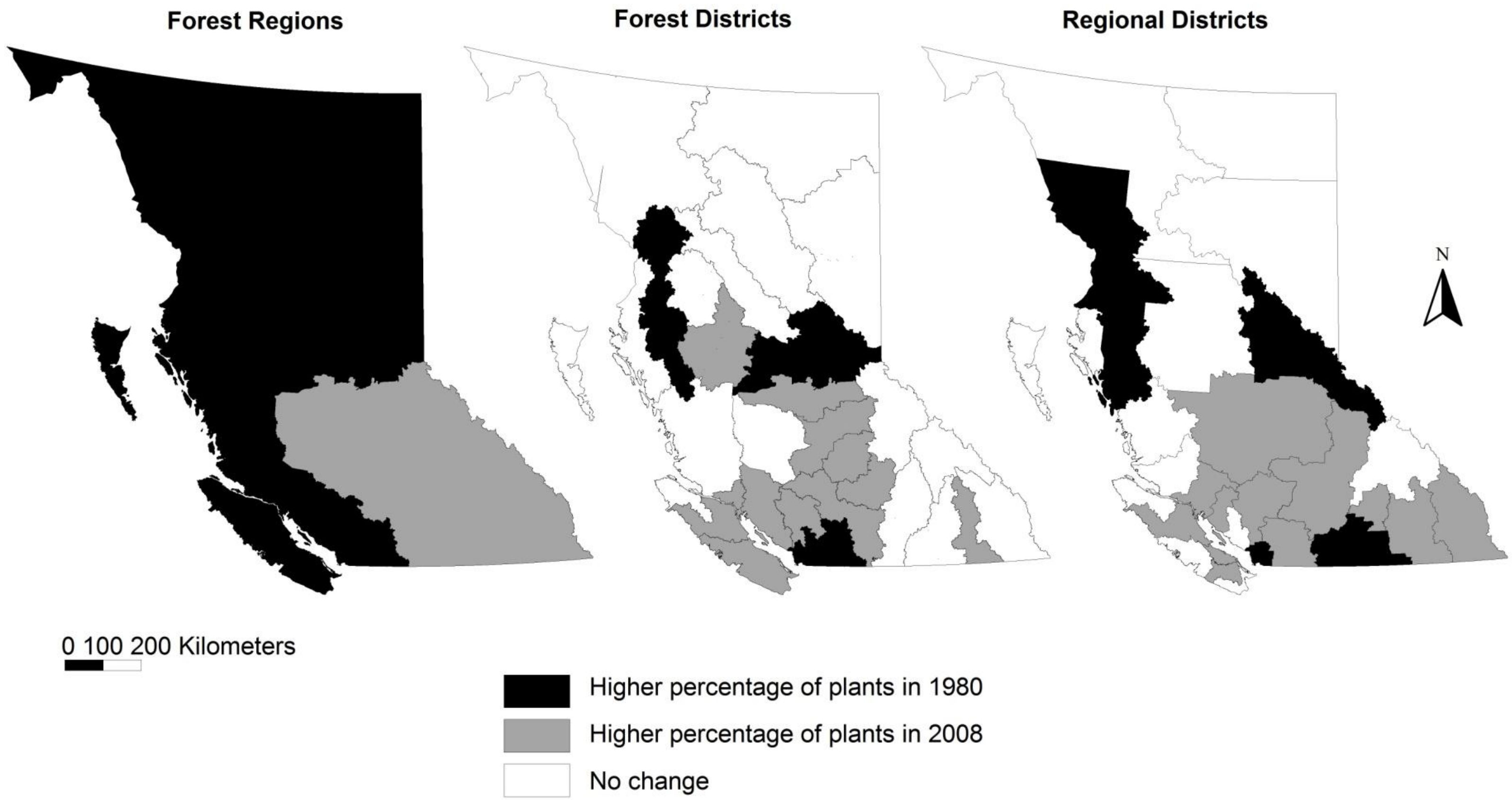
Data: industrial directories

Figure B5 Andresen (2009) test results, large board mills



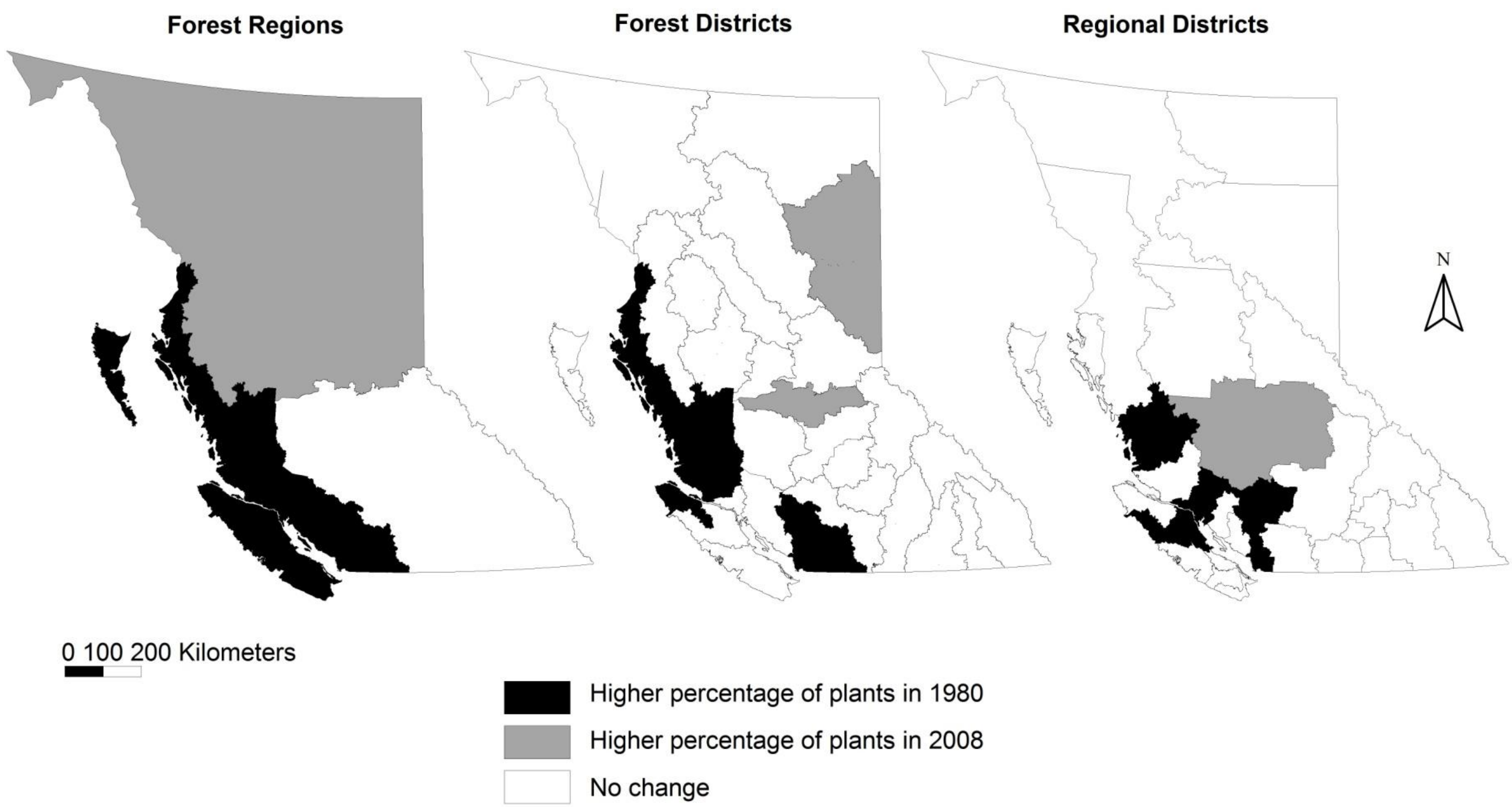
Data: industrial directories

Figure B6 Andresen (2009) test results, value added wood



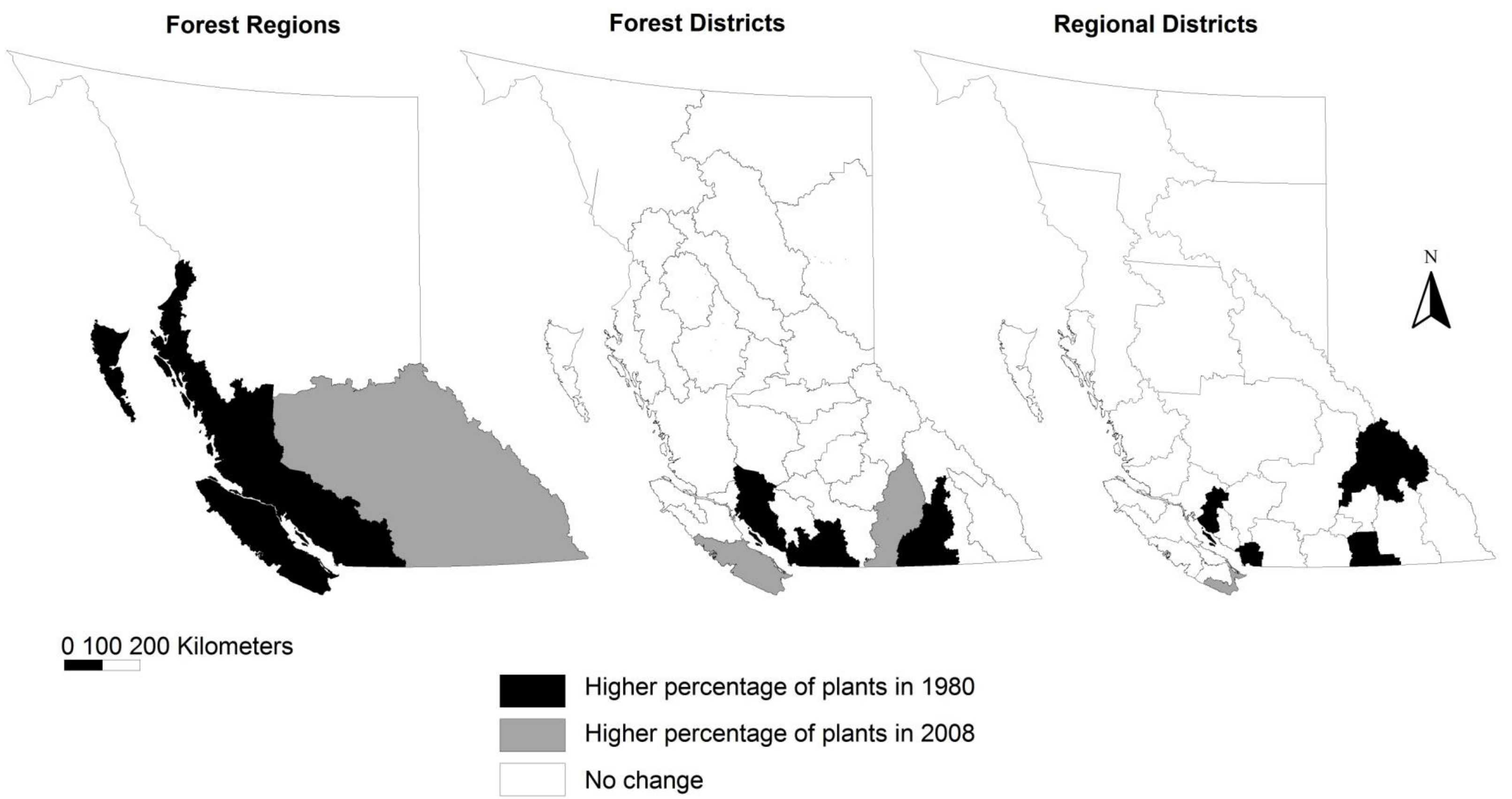
Data: industrial directories

Figure B7 Andresen (2009) test results, pulp and paper



Data: industrial directories

Figure B8 Andresen (2009) test results, value added paper



Data: industrial directories

Appendix C – Sawmill Questionnaire

1

Questionnaire for Sawmills

A. General Information

Respondent ____________________________ Status _______________________________

Name of plant___________________________ Location of plant ______________________

Company (if different)_____________________ Location of head office:__________________

Age of plant :_____________ Age of equipment: ______________

Is the firm owner-managed? Yes ☐ No ☐ Single plant firm? Yes ☐ No ☐

Domestic ☐ foreign owned ☐ specify____

B. Products, Employment and Sales

1a. Indicate major product lines at this plant

2001	2008
1. _______________________(%)________	1. _______________________(%)________
2. _______________________(%)________	2. _______________________(%)________
3. _______________________(%)________	3. _______________________(%)________
4. _______________________(%)________	4. _______________________(%)________

b. Please comment on the changes____

____

2. Indicate annual capacity and production in terms of MMBF

Capacity: 2001___________ 2005___________ 2008___________ now___________

Production: 2001___________ 2005___________ 2008___________

3. Estimate the value of goods distributed?

total sales 2001___________ 2005___________ 2008___________

export sales 2001___________ 2005___________ 2008___________

4a. Estimate total employment numbers at this factory (annual average)

	2001		2005		2008		now	
	M	F	M	F	M	F	M	F
Administrative staff	_____	_____	_____	_____	_____	_____	_____	_____
Secretarial staff	_____	_____	_____	_____	_____	_____	_____	_____
Full time workers	_____	_____	_____	_____	_____	_____	_____	_____
Part time workers	_____	_____	_____	_____	_____	_____	_____	_____

b. Indicate the extent of workforce fluctuations

2001	2005	2008
___________	___________	___________

c. please estimate the average age of employees

2001	2005	2008
___________	___________	___________

5. What percentage of your production workers were skilled?

2001	2005	2008	now
__________%	__________%	__________%	___________%

6a. Is this plant unionized?

Yes ☐ No ☐

b. If yes, are there local variations in collective bargaining agreement?

____

____

c. If no, what is you approach to organizing workers?

Informal ☐ formal collective agreement ☐ individual negotiation ☐

Comment____

____

7a. What is the entry level hourly wage rate at this factory?

2001____________________ 2008____________________

b. What is the average hourly wage rate at this factory?

2001____________________ 2008____________________

8. Indicate work organization features in terms of...

	2001			2008		
	strong	weak	no	strong	weak	no
a. seniority principle	☐	☐	☐	☐	☐	☐
b. job demarcation	☐	☐	☐	☐	☐	☐
c. job rotation	☐	☐	☐	☐	☐	☐
d. self-supervision	☐	☐	☐	☐	☐	☐
e. shift-work	☐	☐	☐	☐	☐	☐
f. bonuses	☐	☐	☐	☐	☐	☐
g. profit sharing	☐	☐	☐	☐	☐	☐
h. non-wage benefits	☐	☐	☐	☐	☐	☐
i. apprentices	☐	☐	☐	☐	☐	☐
k. in-house training	☐	☐	☐	☐	☐	☐
l. external training	☐	☐	☐	☐	☐	☐
m. part-time workers	☐	☐	☐	☐	☐	☐

Comment on trends:____

____

____

9. Can you estimate per unit labour costs (C$ per MBF)?

2001_________________ 2005_________________ 2008_________________

10a. Can you estimate productivity (cubic m per hour)?

2001________________ 2005________________ 2008________________

b. Is there another way you use to measure labour productivity?

Yes ☐ No ☐ If yes, how?____

____

11. a Indicate trends in labour productivity 2001-2008

Strong increase ☐ moderate increase ☐ no increase ☐ decrease ☐

b. what are the main sources of productivity increase/decrease? ________________________

____

____

12. Can you estimate the lumber recovery factor (MBF per cubic metre)

2001________________ 2005________________ 2008________________

13. a Indicate trends in lumber recovery 2001-2008

Strong increase ☐ moderate increase ☐ no increase ☐ decrease ☐

b. please comment ____

____

____

14. How do you make use of your waste wood?

____

____

____

15. Since 2001, have there been changes in the functions and services done within the factory?

Fewer functions or services today☐ More functions or services today ☐

No changes since 2001 ☐

Please indicate____

____

16. How would you describe your relationship with the union/workers in general?

2001____

____

2008____

____

17. Indicate the percentage (%) distribution of sales by major markets

	2001	2005	2008
British Columbia	__________	__________	__________
Rest of Canada	__________	__________	__________
United States	__________	__________	__________
Japan	__________	__________	__________
China	__________	__________	__________
South Korea	__________	__________	__________
E.U.	__________	__________	__________
Other	__________	__________	__________

18. Are you planning to expand or diversify your market areas?

Yes ☐ No ☐ If yes, why?____

to which regions or countries?____________________________________

If no, why not? ____

19. Since 2001, did you take initiatives to...

a. develop new products Yes ☐ No ☐ **b. add value to products** Yes ☐ No ☐

c. Please indicate:

Nature of development____

____

Source of development____

____

Do you use Forintek? Yes ☐ No ☐

20. Compared to the industry average, how would you rank your...

a. process engineering capability? __________________________________

b. product development capability? __________________________________

c. marketing capability? ____

d. Any change since 2001? ______________________________________

____

21. How do you distribute your products?

a. Domestic Sales (in %)	2001	2005	2008
Via a broker	________	________	________
Via direct sale	________	________	________
Other(please specify) ____________	________	________	________

b. Export Sales (in %)	2001	2005	2008
Via a broker	___________	___________	___________
Via direct sale	___________	___________	___________
Other (please specify) _______________	___________	___________	___________

22. Indicate how you ship your products

a. Domestic ____

b. Exports____

c. Have there be any changes since 2001? ____

____

____

C. Input/Raw Materials

23. What mix of species do you use?

2001		2008	
1. ______________________	(%)________	1. ______________________	(%)________
2. ______________________	(%)________	2. ______________________	(%)________
3. ______________________	(%)________	3. ______________________	(%)________
4. ______________________	(%)________	4. ______________________	(%)________

24. What are your sources of log supply? (in %)

	2001	2005	2008
Own logging	___________	___________	___________
Contract logging	___________	___________	___________
Market purchases	___________	___________	___________
Other sources (_________________)	___________	___________	___________

25. Do you hold renewable tenure?

Yes ☐ No ☐ If yes, please specify ____

____

26. What changes in timber supply do you anticipate…

a. next year? ____

____

b. over the next five years? ____

____

27a. Indicate your cost structure (in %)

	2001	2005	2008
Wood supply	___________	___________	___________
Labour and benefits	___________	___________	___________
Interest on capital	___________	___________	___________
Plant depreciation	___________	___________	___________
Fuel & Energy	___________	___________	___________
Taxes	___________	___________	___________
Transportation (distribution)	___________	___________	___________
Other costs	___________	___________	___________

b. indicate your main efforts to control/ reduce costs ________________________________

____

____

28. What was total new investment at this factory?

a. 2001-2006_________________ purpose____

b. Since 2006_________________ purpose____

c. Source of equipment supply____

____

29. How has the MPB affected your current operations and what do you anticipate will be its future impact?

____

____

____

D. The Softwood Lumber Agreement

30. Did you agree with Canada letting the 1996 SLA expire in 2001?

Yes ☐ No ☐ Explain____

____

____

31. In hindsight, what should your firm have done in 2001 at the expiration of the 1996 SLA?

a. Search for new markets? Yes ☐ No ☐

b. New products? Yes ☐ No ☐

c. Consolidated? Yes ☐ No ☐

d. Increased capacity Yes ☐ No ☐

e. Cost cutting technology? Yes ☐ No ☐

f. Other (please specify)____

____

32. In April 2002, the US Department of Commerce announced a combined subsidy and anti-dumping rates of 27.22%.

a. Did this affect your trade with the US? Yes ☐ No ☐

Explain____

b. Did it initiate closer looks into other foreign markets? Yes ☐ No ☐

c. Any other changes? ____

____

33. Do you feel your firm has been hurt more or less by the SL dispute compared to most sawmills?

Yes ☐ No ☐ Explain____

____

34. What were your factory's responses to the period of litigation from 2001-2006? Explain

____

____

____

35 a. Are you in favour of the 2006 SLA?

Yes ☐ No ☐ Explain____

____

____

b. Would you like Canada to withdraw?

Yes ☐ No ☐ Explain____

____

____

36. How did your factory respond to the 2006 agreement?

____

____

____

37. How did your firm utilize the escrow from litigation?

____

____

38a. Has the 2006 SL dispute affected your trading patterns and/or marketing?

Yes ☐ No ☐ Explain____

____

____

b. has it given your firm certainty?

Yes ☐ No ☐ Explain____

____

____

c. how is it affecting future planning? ____

____

____

39. At what C$ price for lumber would your plant have to stop producing under prevailing conditions?

____

40. What C$ price for lumber is required for long term economic viability?

____

41. Was your firm involved in the discussions about the creation of the 2006 SLA?

Yes ☐ No ☐ Explain____

____

____

42. Would you like to have been included?

Yes ☐ No ☐ Explain____

____

____

43. Which factors had impact on the profitability of your plant? (please rank)

	2001			2008		
	strong	moderate	weak	strong	moderate	weak
SL dispute	☐	☐	☐	☐	☐	☐
Energy costs	☐	☐	☐	☐	☐	☐
Value of C$	☐	☐	☐	☐	☐	☐
US housing market	☐	☐	☐	☐	☐	☐
Labour cost	☐	☐	☐	☐	☐	☐
Other factors	☐	☐	☐	☐	☐	☐

(please indicate)____

E. Summary

44a. Please list the industry associations your are a member of

1. ______________________________ since when?__________
2. ______________________________ since when?__________
3. ______________________________ since when?__________
4. ______________________________ since when?__________

b. What are the benefits and challenges of membership?

Benefits: ______________________________

____

Challences:______________________________

____

45. Can you comment on recent government policy measures, such as...

a. appurtenancy______________________________

b. biofuel______________________________

c. the roundtable______________________________

d. market auctions______________________________

e. community forests______________________________

46. The industry has lost many firms, so many plants have gone under and you have been able to survive. How have you done it?

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