FIBRE SUPPLY ISSUES OF THE BRITISH COLUMBIA

LOG HOME MANUFACTURING INDUSTRY

by

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ABSTRACT

British Columbia's log home manufacturing industry's fibre supply problems have been documented since 1992. To better understand the issues, an industry wide mail survey of 171 companies was conducted to assess production, sales, markets employment, fibre sources, fibre consumption, fibre costs and alternate fibre usage. The responses provided information on the current status of the industry, its fibre supply characteristics and use of alternative fibre supplies, such as insect killed, fire killed and second growth timber.

A sample size of 42 resulted in a 24.6% response rate achieved in the mail survey. Over 90% of respondents reported using hand crafted production methods. The most common product category manufactured was the custom log home "not to lock up" with an average unit price of $71,100, which generated $905.36 in sales per cubic metre of fibre utilized. On average, each respondent consumed 1723 cubic metres of fibre, employed 12.5 full time equivalent personnel and produced 14.6 units per year to generate gross annual sales of $1.1 million. The major markets for BC's log home industry were the United States (46%), British Columbia (31%) and Asia (13%). Of the 55,119 cubic metres of fibre recorded as purchased by respondents, 69% was from the Vancouver and Kamloops forest regions. This fibre was primarily obtained from logging company dryland sortyards, with Douglas fir (*Pseudotsuga menziesii* [Mirb.] Franco) the preferred species. The weighted average delivered price of all fibre purchased was $153.67 per cubic metre. In addition to old growth timber, insect killed and second growth timber were used as alternative fibre sources with 58.5% of respondents reporting usage of these materials. Just over 26,300 cubic metres of this alternative fibre was purchased by respondents with a weighted average delivered price of $127.60 per cubic metre.

The respondents' opinions indicate inconsistent fibre supply and high fibre costs had the greatest impact on the industry's performance. To resolve fibre supply issues, the log home manufacturing industry strongly favoured policy changes to existing fibre allocation programs and the creation of quota systems, over developing business relationships with organizations able to supply fibre.

Key Words: log buildings, fibre, forest industry, insect killed timber, mail survey, secondary manufacturing, timber frame building

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1 INTRODUCTION

This study investigates fibre supply issues relating to the British Columbia (BC) log home manufacturing industry which includes companies manufacturing the following products:

- handcrafted log homes,
- machine profiled log homes, and
- timber frame and timber frame/log home hybrid structures.

Fibre used in their manufacturing processes is green or dry whole logs:

- with a minimum top diameter of 20 centimetres,
- all bark removed, and
- composed fully of sound wood (International Log Building Association, 2000).

These logs are commonly known as house logs by the forest industry but for the purpose of this research will be referred to as fibre. Fibre used by this industry are either peeled and notched, machine profiled or milled into large cants and used in both structural and non-structural building elements. On average, 90% of the building material used to manufacture a log home is logs (Stennes and Wilson, 1999).

The BC log home manufacturing industry is a small but expanding sector within BC's forest industry. In 2001, the industry contributed 0.5% to the province's forest products export total. The industry has increased output over the last several years while the primary forest industry has reduced output due to decreasing commodity prices (Woodbridge, 2002). In 2001, the international market for log homes packages was over $2 billion with sales tripling since 1986 (Log Home Living, 2002). BC's log home manufacturing industry gross sales for 1996 was $114 million with a majority of sales occurring in BC, the United States (US) and Japan (Westcoast CED, 1999).

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The industry currently has difficulty in securing a consistent supply of high quality fibre to ensure production levels meet market demand. Exploratory research (Stennes and Wilson, 1999; Houdek, 2001; Wilson *et al.*, 2001) and personal interviews (Dowdeswell, 2002[1]; Savignac, 2002[2]) confirmed supply side constraints noting that securing an adequate volume of timber meeting size and quality parameters was the most prevalent factor limiting industry expansion. Research into the broader secondary wood products manufacturing industry has also revealed industry-wide fibre supply challenges (FRDA, 1992; Wilson, 1996a; Wilson, Stennes and Wang, 1999b; Woodbridge, 2000; Wilson *et al.*, 2001).

Given the general consensus that fibre constraints exists, the research focuses on the BC log home building industry fibre supply issues that could be partially resolved through identifying preferred log characteristics and sizes, alternative sources of fibre to old growth timber, and favourable business practices that could improve fibre supply chains. The research objectives of this thesis are:

1. to assess the current state of the BC log home building industry;
2. to identify fibre supply characteristics of the industry; and
3. to investigate the use of alternative fibre supply sources.

The thesis is organized as follows:

- Section 1, Introduction and Literature Review,
- Section 2, Background,
- Section 3, Methodology,
- Section 4, Research results,
- Section 5, Discussion, and
- Section 6, Conclusion.

1.1   LITERATURE REVIEW

The literature review organizes articles into three sections:

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[1] Mr. Russ Dowdeswell, Director of Fibre Acquisitions, The Log Building Industry Association of British Columbia
[2] Mr. Robert Savignac, Executive Director, The International Log Building Association

- articles describing the BC log home manufacturing industry exclusively,
- articles describing the BC secondary manufacturing industry, and
- other related articles that provide background information.

Each article is briefly described and its weak points in addressing the industry's fibre supply issues discussed.

1.1.1 BC log home manufacturing industry

Houdek's (2001) report, *Overview of the Log Building Industry in British Columbia*, focussed primarily on the level of technological sophistication of log home manufacturing companies and its effect on productivity levels versus company size and production system. Of the industry's challenges, the study found that securing an adequate and consistent fibre supply was the industry's single largest problem. The study did not identify why a fibre supply problem existed but did report the industry was addressing the issue through several programs, one being the creation of a "virtual log yard" to accumulate fibre (Houdek, 2001).

Stennes and Wilson's (1999) report, *An Overview to Log Home Manufacturing in British Columbia,* was based on data from mail surveys conducted in 1991 and 1997 of BC's secondary manufacturing industry. The first half of the overview compared 1991 and 1997 results on population estimates, total sales and employment levels, sales by market distribution, and species use distribution for the BC log home manufacturing industry. The second half reported 1997 statistics comparing the log home industry to the rest of secondary wood products manufacturing industry in the following areas: raw material type used, job maintained per 1000 cubic metres consumed, gross sales per cubic metre utilized, average cost distribution, capacity utilization and expansion plans and constraints to expansion. The report's two major conclusions were: 1) 100% of log home companies reported fibre supply as a constraint to expansion, with 72% of respondents identifying volume and 52% identifying price as the source of the problem, and 2)

the fibre supply constraints of the log home manufacturing industry were different to fibre supply constraints experienced by the rest of the secondary manufacturing industry.

The study's results must be carefully interpreted because of design flaws in the survey, in particular answer categories that did not allow accurate reporting by log home manufacturing company respondents. An example of these flaws was the inclusion of the SPF (spruce-pine-fir) lumber category in the tree species use distribution diagram. SPF is not a tree species, but a lumber product used as an input material by the secondary wood products manufacturing industry. Since the distribution diagram included both Pine (*Pinus spp.*) and Spruce (*Picea spp.*) in addition to the SPF category, the answers could have influenced double counting resulting in an inaccurate species utilization calculation. The second example was the reported distribution of potential log supply sources. The BC Market sales category aggregated several possible log supplier sources, such as logging company dryland sortyards, log brokers, log wholesalers and private land owners. Each of these subcategories individually provides substantial amounts of fibre to the industry. The inclusion of Other Tenure in the list of timber tenures included as possible fibre sources was also misleading, as log home manufacturers can only be granted Category II Small Business Forest Enterprise Program[3] timber sales.

Wilson *et al's.*, (2001) report, *The structure and economic contribution of secondary manufacturing in British Columbia: 1990-1999*, included a summary of the BC log home manufacturing industry. This summary was based on a 1999 mail survey that was conducted on the entire secondary wood products manufacturing industry. The information presented included: population estimates, industry level employment and sales estimates, sales by market, species use distribution, log supply sources, jobs maintained per 1000 cubic metres of fibre,

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[3] The Small Business Forest Enterprise Program was renamed on April 1, 2003 to BC Timber Sales.

capacity utilization and expansion and major constraints to expansion. In describing the log home manufacturing industry, the study found that the log home manufacturing industry:

- exports nearly 90% of total sales outside of Canada,
- generates 3.2 more direct jobs per 1000 m^3 consumed compared to the secondary manufacturing industry average of 0.6, and
- the main expansion constraints are wood supply and labour while markets and finance limit the rest of the secondary manufacturing industry (Wilson *et al.*, 2001).

Unfortunately, the same survey design flaws that were made by Stennes and Wilson (1999) were repeated in this study. These flaws, including SPF lumber in the tree species use distribution and the limited number of log supply source categories, produced results that were again inaccurate. For example, SPF lumber was ranked as the second most used tree species, just one percent behind the most common species (Wilson *et al.*, 2001). The inclusion of SPF may have significantly reduced the frequency of Pine and Spruce reported by respondents, and therefore affected the overall species distribution and their relative importance to the industry. A more realistic raw material input comparison would be logs versus lumber, panels and other wood products, and separately tree species use based on data collected for log inputs.

The lack of more applicable log supply source categories also caused distortions, with a majority of respondents indicating over three-quarter of the industry's fibre supply was secured through BC Market Purchases. Several supplier sub-types are present in this category, such as logging company dryland sortyards, log broker, log wholesalers and private land owners, and their relative importance to the industry is therefore unknown.

In all previous reports on the BC log home manufacturing industry, wood supply was ranked as the primary constraint to industry expansion. Wilson *et al.* (2001) reported labour had superseded wood supply as the primary industry expansion constraint, which may indicate that the industry's fibre supply problems had improved since 1997.

The Westcoast CED (1999) report, *The Market for Log Homes – An Assessment*, provided product definitions and global production and markets of log homes. It focussed primarily on providing a business plan design with several market penetration strategies for initiating a machine profiled log home manufacturing company for an aboriginal business development association in the Prince George of BC. It also included the findings of an unpublished 1996 BC log home construction industry survey[4]. In this study, fibre supply was noted as a constraint to industry expansion with survey respondents indicating that high log prices (81%), the inability to obtain an increased volume of building logs (68%) and inadequate log quality (53%) were the key factors affecting company growth when compared to other constraints due to labour, capital, and marketing or management skills (Westcoast CED, 1999).

1.1.2   BC secondary wood products industry

The log home manufacturing industry is an important part of the secondary wood products manufacturing industry. However, information on the log home industry is often lost because secondary manufacturing industry surveys focus on companies that require commodity type lumber inputs and possess automated manufacturing lines to create products such as, laminated beams, roof and floor truss systems, prefabricated modular buildings, treated wood products and laminated veneer lumber. This is unrepresentative of the BC log home manufacturing industry, which requires for the most part unprocessed logs and large cants, and where a majority of companies utilizes hand crafted production techniques.

In the Wilson, Stennes and Wang (1999a) study, *Secondary Manufacturing in British Columbia: A Regional Breakdown*, the authors analyzed 1991 and 1997 population levels, markets, sales and employment data for the secondary manufacturing industry by BC forest

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[4] Author unknown. Survey funded through Forest Renewal BC grant and conducted by the Log Building Industry Association of British Columbia

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region based upon mail survey data. The study determined that wood supply ranked first as a constraint to the secondary manufacturing industry expansion in all six forest regions when compared against labour and markets.

The PriceWaterhouseCoopers (1993) study, *Performance of the Value-added Wood Products Industry in British Columbia,* provided sales, employment, capacity utilization and expansion plans and major constraints to expansion results. Again, the study emphasised that the lack of secure wood supply with right sizes, quality and price was a serious constraint. It reported that the industry needed to improve by:

- enhancing industry margins in order to better compete for raw material, and
- developing mature business relationships between primary and secondary producers

The Forintek and McWilliams (1993) study, *Structure and Significance of the Value Added Wood Products Industry in British Columbia,* provided the first definition of the value added wood products industry as "secondary wood product manufacturers that add value to commodity wood products or wood based material by further processing it into specialty finished or semi-finished products". The definition was modified slightly in later reports and renamed the "secondary wood products manufacturing industry".

1.1.3 Other related documents

There are numerous documents such as government publications, consultant reports and industry association and magazine Internet websites also available. Wilson (1984) gave a detailed history on log home construction developments in Europe and its influence on North America log home construction. Muir and Osborne (1983) reported historical use of log homes and some details on log building construction. The Ministry of Forests (1997 & 2003) provided data on the value of timber harvested from provincial forest tenures.

Consultants' reports (Mater, 1999; Woodbridge and Associates, 2001; Woodbridge, 2000, 2002 & 2003) covered market research and weakness in BC's timber tenure system and its

affect on available fibre supply. They also provided strategies to improve the secondary wood products manufacturing industry output or viability.

The International Log Building Association (ILBA) and Log Building Industry Association of British Columbia (LBIA) provided Internet articles that promoted the industry, voluntary building standards and company information. The industry magazine, Log Home Living, had many articles available: log home production reports, benefits of owning a log home, maintenance tips and articles for do-it yourself enthusiasts and how to be your own general contractor.

1.1.4   Literature review summary

The BC log home manufacturing industry studies provided data on population size, fibre supply sources, sales, employment, capacity utilization, expansion plans and constraints to expansion. Most studies indicated fibre supply as the primary industry constraint to expansion followed by labour, but several reports were flawed and provided misleading or incomplete data. One common weakness was a lack of detailed analysis into the underlying causes of fibre shortages. Secondary wood products manufacturing industry studies do not provide reliable data on the BC log home manufacturing industry due to dissimilarities in company sizes, input materials, production methods and markets. Other related documents provided historical and industry importance material but largely avoided the fibre supply issue. Therefore, this study attempts to fill these gaps in the literature, by providing more detailed data on industry characteristics, fibre availability, quality and cost, and alternative fibre sources.

2 BACKGROUND ON THE BC LOG HOME MANUFACTURING INDUSTRY

Section 2 is comprised of four parts:

- a brief history of log home construction,
- an overview of the BC forest products industry,
- a review of the BC secondary wood products manufacturing industry, and
- a review of the BC log home manufacturing industry.

2.1 A BRIEF HISTORY OF LOG HOME CONSTRUCTION

The use of logs as the main building material for habitable human dwellings is widespread among prehistoric cultures with known use occurring in North America, Europe, Japan, Scandinavia and Russia (Janzen, 1980; Muir and Osborne, 1983; Wilson, 1984). From as early as 8000 BC, structures have been built utilizing logs laid horizontally and notched at the corners for increased strength, stability and security (Wilson, 1984). By the 17th century, the horizontal, interlocking log wall construction technique was predominant in rural areas of Scandinavia, the Baltic countries, Russia, Germany and Switzerland (Wilson, 1984). Migrants from Europe to North America continued the same log building construction methods in their new homeland for the next 250 years. In the late 19th century, log home construction fell out of favour when it became easier and cheaper to assemble lumber frame style buildings (Peters, 2000). By the 1990s, log homes were popular again as a primary residence (Court, 1997), and this helped expand the BC log home manufacturing industry.

The most common style of log home building construction method used today, the Scandinavian Full Scribe (Westcoast CED, 1999), closely follows the traditional techniques brought over by the first Swedish settlers who arrived in 1638 (Wilson, 1984). This style is characterized by:

- logs left fully round,
- a groove cut the entire log's bottom length,
- notches cut in the top or both sided about 30 centimetres from the each end log, and
- logs overlapped at each building corner.

Properly built log buildings can last several centuries with some reported at greater than one thousand years old (Muir and Osborne, 1983).

2.2   AN OVERVIEW OF THE BC FOREST PRODUCTS INDUSTRY

Since the late 1800s, BC's economy has been dominated by the forest products industry. It expanded rapidly given the natural endowment of forest resources made an ideal material supply coupled with increasing global demand for forest products.   The industry is still one of the global leaders in forest products exports contributing some 8% to the global trade value (Ministry of Forests, 2003).   In 2002, the forest industry:

- harvested 73.4 million m3,
- generated $14.4 billion in sales,
- provided $1.296 billion in crown forest revenue,
- contributed $4 billion to municipal, provincial and federal governmental revenue,
- employed directly and indirectly over 270,000 people, and
- accounted for 49.8% of the total provincial exports and 8.07% of provincial GDP.

(Sources: Council of Forest Industries, 2003; Ministry of Management Services, 2003b; Ministry of Forest, 2004 & 2004a).

Today, BC's forest industry is losing ground in its traditional markets to other competitors due to several factors: high wood extraction and labour costs, unfriendly regulatory and investment climate, outdated timber tenure system, uncertain access to fibre and a corporate mindset focused on production oriented, low value output (Woodbridge, 2003).

2.3   A REVIEW OF THE BC SECONDARY WOOD PRODUCTS MANUFACTURING   INDUSTRY

Improving the capacity of BC's secondary wood products manufacturing industry is important to the province. BC can no longer depend on the "commodity" forestry industry to

increase production and employment levels due to a lack of additional timber reserves and

expansion of regulatory, environmental and social constraints (Wilson *et al.*, 2001). The only

area for substantial growth lies in expanding the secondary wood products industry. However,

its expansion has languished in comparison to other provinces that promoted higher levels of

secondary processing of primary manufacturing output over the last decade (Ministry of

Management Service, 2003a).

In 1990, BC's secondary industry ranked first in Canada in value added wood exports by

shipping 35% of the total Canadian value (Ministry of Management Services, 2003a). Canada's

secondary industry experienced a compound annual growth rate of 25% over the last ten years,

but by then BC dropped to third place at 14% (Figure 1).
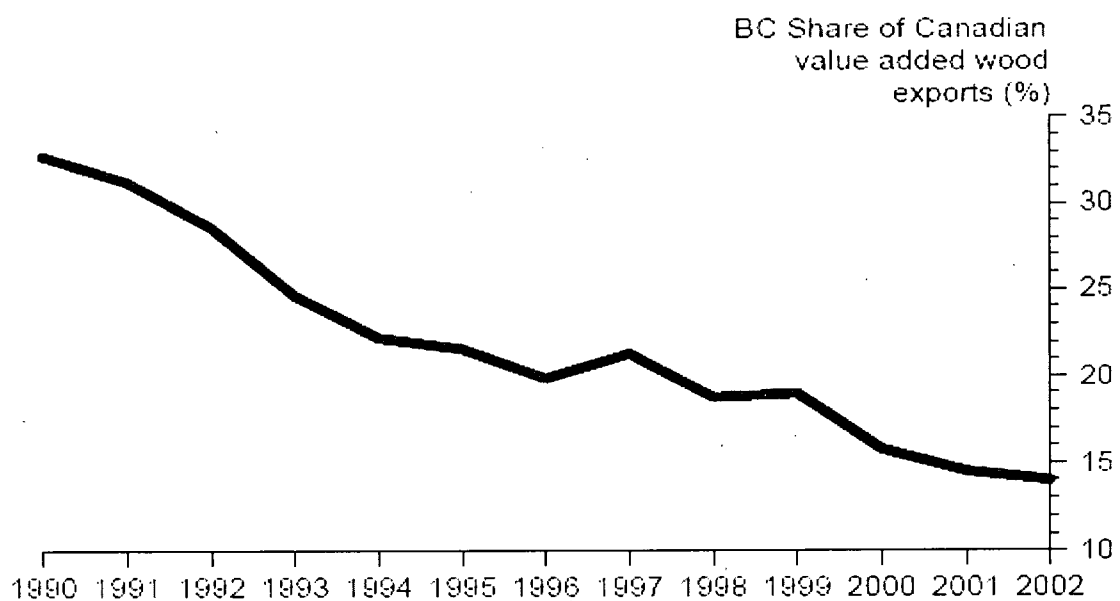
Figure 1. BC's share of Canadian value added wood exports
Source: Ministry of Management Service, 2003a.

From 1990 to 2002, BC tripled value added wood product exports but had the second lowest

provincial value added to total wood product exports ratio of 10.5 % with the Canadian average

at 30.3% (Ministry of Management Service, 2003a) (Figure 2).
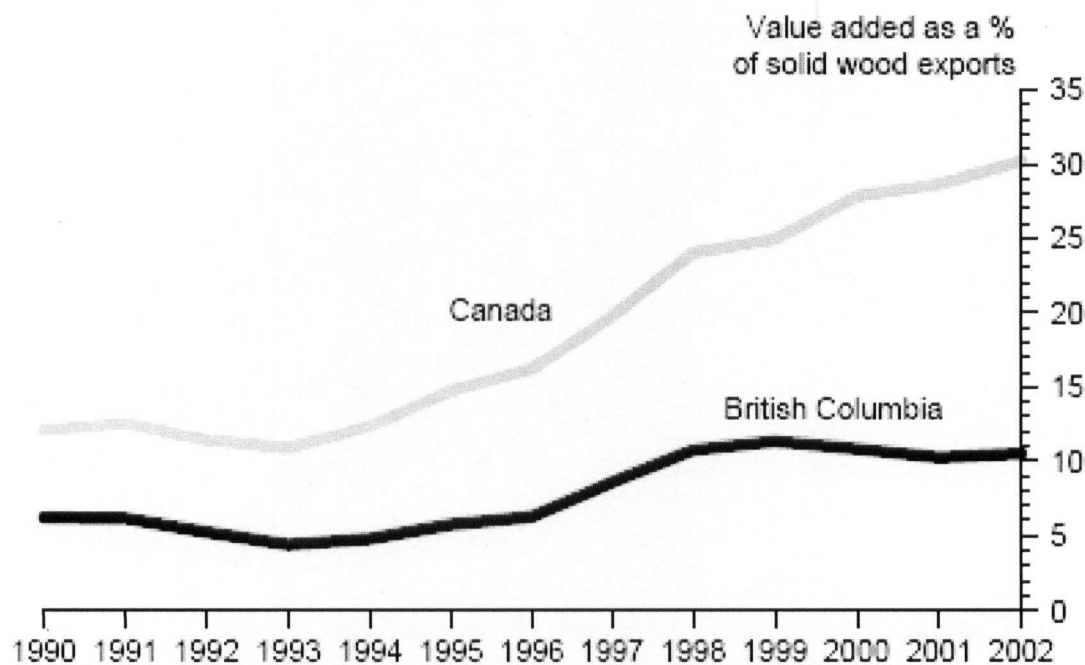
Figure 2. Value added wood products to solid wood products exports ratio for BC and Canada
Source: Ministry of Management Service, 2003a.

In 1999, the BC secondary wood products industry generated $4.68 billion in sales, over

a quarter of the forest industry sales, but generated four times the amount of jobs per equivalent

amount of timber (Wilson *et al.*, 2001). The province's solid wood products export totals peaked

in 1999 and has since declined mostly due to reduced lumber and pulp prices, non-tariff barriers

to export and high logging and stumpage costs (Pearse, 2001).

BC is positioned favourably just north of the largest consumer of value added wood

products, the US, and in particular the Western States. BC's secondary manufacturers currently

hold one percent of the US value added wood market and if increased to five percent, the forest

industry's total sales would double without any increase in timber harvest levels (Woodbridge,

2000).

2.4 A REVIEW OF THE BC LOG HOME MANUFACTURING INDUSTRY

Companies within the BC forest products industry operates in two broad groups: primary and secondary manufacturing companies. Primary manufacturing companies utilize logs to produce commodity type wood products such as, lumber, pulp, paper and panels (Woodbridge, 2002). The secondary manufacturing industry utilizes both wood and log products to produce higher value semi-finished and finished wood products (Wilson, Stennes and Wang, 1999b). The log home manufacturing industry falls within secondary manufacturing category utilizing log products (See Appendix 1).

The more common classification system for the secondary manufacturing industry is by business type. There are nine business types with a total of twenty-nine subgroups with log home products categorized in the engineered wood products business type (Table 1).

Table 1. The nine business types of the secondary manufacturing industry

1. Remanufactured products
   - lumber specialties
   - custom processing
   - cutstock
   - decking
   - Sawmill specialties
   - fencing
   - siding

2. Engineered wood products
   - laminated beams
   - trusses
   - prefab buildings
   - log homes
   - treated wood
   - laminated veneer lumber

3. Millwork
   - doors/windows
   - moulding
   - flooring
   - architectural wood
   - turned wood
   - stairs

4. Cabinets
   - kitchen cabinets
   - cabinet doors
   - countertops
   - vanity cabinets

5. Furniture
   - household
   - ready to assemble
   - commercial/ industrial
   - patio

6. Pallets and containers
   - pallets
   - shipping material
   - boxes, bins and crates

7. Shakes and shingles

8. Panelboards
   - plywood
   - particleboard
   - oriented strandboard
   - medium density fibreboard

9. Other wood products
   - poles and posts
   - veneer
   - instruments
   - wood novelties
   - woodcrafts

Source: Wilson *et al* (2001)

The major drawback of this classification system is the failure to separate the log home manufacturing companies from other companies producing products such as, laminated beams, trusses and prefabricated homes. The log home manufacturing companies are typically smaller, labour intensive, export market oriented and require whole logs and large cants as their primary raw material. The latter instead are larger, highly automated, domestic market oriented and require lumber and panels as the primary raw material.

In 1996, Canada ranked third in log home sales, manufacturing $189 million, with BC's sales contributing $113 million (Westcoast CED, 1999). In 1997, the LBIA reported similar sales of $114 million, directly employing 1800 people and contributing greatly to economic diversification and community development within BC (Log Building Industry Association of British Columbia, 2002). The industry is very labour intensive, generating one of the highest levels of employment per thousand cubic of logs in the secondary wood products manufacturing industry (Wilson *et al.*, 2001). The major export markets of log homes are the US, Japan and Europe while a significant BC market exists. In 2001, the US purchased $1.7 billion of log homes with BC having a market share of $34 million, but expansion possibilities existed if fibre supply issues were addressed (Westcoast CED, 1999).

In 1996, approximately 130 log home manufacturing companies operated within BC and consumed 200,000 m3 of fibre that consisted mostly of unprocessed logs and large cants (Log Building Industry Association of British Columbia, 2002). Three-quarters of the fibre was sourced through BC log market sales and the remainder through the Small Business Forest Enterprise Program (Wilson *et al.*, 2001). However, log suppliers often lacked a consistent supply of house logs that met size and quality requirements, even though log home manufacturing companies were willing to pay 20% and greater premiums to ensure their log supply needs were met. (Dowdeswell <u>pers. comm.</u>, 26 Sept. 2002).

3   METHODOLOGY

Section 3 describes the four phases of the research:

- define the population,
- design the mail survey,
- implementation of the mail survey, and
- analyze data.

3.1   POPULATION DEFINITION

To identify log home manufacturing companies in the province of British Columbia I

used the Forintek and McWilliams (1993) definition of a company as "those who prepare and

preassemble log structures at their place of business". Later, this definition was modified since

1. some companies do not need to preassemble their buildings and 2.companies must incorporate

industry building standards produced by the International Log Building Association (2000).

Therefore, all companies in this research had two primary characteristics:

- premanufacture habitable structures at their place of business, and
- building material are solid logs or cants greater than 20.0 cm. in diameter or width.

This definition includes all log home structures made of solid, hand notched logs,

manufactured or profiled logs and cants, and sawn timbers utilized in timber frame homes.

The research population was all log home and timber frame manufacturing companies in

British Columbia, and a sample frame of 232 companies was identified. For a majority of these

companies, contact information was gathered from the Telus Superpages website under the Log

Cabins/Homes/Buildings category and information from the internet (See Appendix 2).

3.1.1 Refinement of the sample frame

Many errors were found in the sample frame, in particular, incomplete addresses and companies not producing log structures. To correct address errors, I conducted more intense research, attempted to email a contact person or telephoned the company. If the company could not be reached after these three steps, it was removed from the sample frame. The types of companies not producing log structures removed from the sample frame list provided these services: panabode style buildings, log chinking, log home renovation, log home sales, exports and transport and metal products associated with log building construction. After these steps, the sample frame was adjusted to 191 companies.

3.2 MAIL SURVEY DESIGN

The mail survey consisted of cover letters, a questionnaire and a request form (See Appendix 3 to 5). The cover letters identified the researcher and the research purpose in relation to the industry's fibre supply challenges. The questionnaire collected data on company business results, practices and opinions. The request form asked companies to participate in an onsite visit of their manufacturing facilities and/or receive a copy of the survey results.

3.2.1 Cover letters

The mail survey design required a total of four cover letters (Appendix 3.1 to 3.4) at different stages of the implementation timeline. The first cover letter was a pre-notification letter mailed to all companies in the refined sample frame for the purpose of identifying the researcher and notifying the companies of the forthcoming questionnaire. The second cover letter was mailed to all companies in the refined sample frame as part of the first mail out of the survey package. The cover letter included the following information:

1. identifying the researcher and the organization conducting the mail survey
2. the purpose of the research in relation to their industry
3. the benefits of participating in the mail survey

4. researcher contact information
5. thanking the company for participating.

The survey package consisted of a cover letter, questionnaire, stamped return envelope and request form. The third cover letter was mailed to all companies in the sample frame reminding them to respond to the survey and thanking them for their participation if they had already responded. The fourth cover letter was included in the second mail out package and mailed to all non-respondents of the first mail out of the survey package. The fourth cover letter was the same as second cover letter, but further emphasized the benefits of responding to the survey.

3.2.2 Survey questionnaire

The survey questionnaire was designed to collect log home manufacturing company production and financial results, fibre supply characteristics, methods of assessing log purchases, alternate sources of fibre supply, methods for resolving fibre supply issues and general questions. The questionnaire was pretested on executive council members of both BC log home building associations and two log home manufacturers in Alberta. The questionnaire was printed in a four page booklet-style format composed of six sections totalling thirty-one questions (Appendix 4). Each respondent was asked to report only their Year 2002 results. The survey concluded with a thank you statement and researcher contact information. Questionnaires were numbered for the purpose of identifying respondents to remove them from subsequent mailing lists.

3.2.3 Request form

Each survey package included a request form allowing respondents to indicate a willingness to participate in an onsite visit of its manufacturing site by the researcher[5] (Appendix 5). Also included was an area to indicate that the respondent wished to receive a free copy of the

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[5] Site visits were not completed due to a lack of funding

research results. For either request, the company was asked to provide its operation's contact information. The request form was requested to be faxed to the researcher.

3.3   MAIL SURVEY IMPLEMENTATION

Conducting the mail survey followed Dillman's (2000) total design method with the following implementation dates:

1. mailing of pre-notification letter – February 15, 2003
2. first mailing of survey package – February 22, 2003
3. thank you/reminder letter – March 1, 2003
4. second mailing of survey package to non respondents – March 29, 2003.

Dillman's fifth step, a third mail out via courier of the survey package with a new cover letter, was not included in the research methodology due to lack of funds and time.

3.4   DATA ANALYSIS

The four steps of data analysis were: 1. Develop an answer code sheet prior to distribution of the mail survey for the purpose of defining numeric values to answers provided by the respondents. 2. Review all responses to categorize valid from invalid survey responses and to clarify individual responses for data entry. 3. Enter data into a MS Excel 2000 spreadsheet. 4. Use both descriptive and inferential statistics to analyze data collected and test for non-response bias using Microsoft Excel 2000 and SAS, respectively. For the inferential statistics, an alpha level = 0.05 was used in the calculation of 95% confidence intervals. The remainder of this section provides further detail on these four steps.

3.4.1   Answer code sheet

An answer coding sheet was developed to transform survey responses into numeric data to allow for statistical analysis. Answer coding was completed to 1. input respondents' numeric and non-numeric data, 2. categorize answers that were illegible or incorrectly provided, 3. report

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whether filter questions were followed correctly, and 4. indicate non-response to a question. Numeric data was entered directly while non-numeric data were assigned category numbers.

3.4.2   Mail survey responses

All mail survey responses were classified into two categories: invalid and valid. Invalid responses included surveys that were returned unanswered or with comments unrelated to the project. Valid responses were returned questionnaires that were fully or partially answered. All questions within each valid response were reviewed to ensure answers were clearly marked. A Ambiguous or unclearly marked answers were either tallied as a non-response or corrected by the researcher corrected in one of two ways: 1. the researcher clearly marked the indicated response or clarified numerical answers (e.g. taking the average of two numbers when a single number answer was requested), or 2. the respondent was telephoned and clarified their answer.

3.4.3   Data entry

Numeric data was separated into two categories based upon response to the first or second survey as determined by identification numbers. A master data set of all responses was then created with six separate subsections corresponding to the survey sections. The subsection data was used in the statistical analyse. The respondents' comments in the last survey question were also compiled.

3.4.4   Attitude measurement scales

The statistical analyses were dependent upon the measurement scales used. All four measurement scales common to survey design was used.
Several survey questions collected data using nominal scales: dichotomy questions to categorize respondents, types of products manufactured, company location and gross sales by category. This data was analyzed and reported using relative frequencies and histograms.

Ratio scales were used to collect financial and production results, the amount of fibre purchased by forest region and supplier type, fibre cost by species, employee information, etc. These results were calculated as relative frequencies and reported in tables and diagrams.

Ordinal scales were used to rank the top three practices of dealing with fibre that fails their quality criteria and reasons why orders to start log home projects were declined. A scale of one to three was used with one being the most common practice and three being the third most common practice. This data was reported as relative frequencies.

Interval scales were used in three question utilizing Likert scales for collecting data on business philosophies, as they pertain to fibre supply issues. These scales utilized a five-point interval scale, with one equalling to "strongly agree" and five "strongly disagree". Data means and standard deviations were calculated and means ranked and reported in tables. Ninety-five percent confidence intervals were computed for each mean and results reported in diagrams. Each statement mean and confidence interval was tested against the midpoint point of three to determine if the statement mean was significantly different from the neutral attitude. Another interval scale that was used was a five-point numeric scale to collect data on preferred log and supplier characteristics, with one equalling "not at all important" and five "extremely important". Data means and standard deviations were calculated and means ranked and reported in tables. Ninety-five percent confidence intervals were computed for each mean and results reported in diagrams. The Scheffe post hoc test was used for grouping of significantly different groups of statements.

The respondent's comments to Question 31 were reviewed and then major themes were identified. These themes were identified by numbers and then tallied to determine the most common themes.

4   RESEARCH RESULTS

Section 4 summarizes the mail survey response statistics and results of survey's six

sections listed below:

- Production and financial data
- Fibre supply characteristics
- Current methods of assessing log purchases
- Alternate sources of fibre supply
- Resolving fibre supply issues
- General questions.

All results present are based on respondents' data only with no industry level estimation

of size, sales, or fibre consumed provided.

4.1   SURVEY RESPONSE STATISTICS AND AGGREGATE RESULTS

4.1.1   Mail survey response

An initial population size of 191 entities was included in the first mail out of the survey.

Survey response by mail out phase is reported in Table 2.

Table 2. Mail survey response

	Number of surveys sent	Number of valid survey responses	Number of elements removed from sample frame	Number of surveys returned unanswered
First mailing	191	32	20	1
Second mailing	138	10	0	5
Total		42	20	6

With the initial mail out of 191 survey packages, 32 completed or partially completed

surveys were returned. Due to the detailed nature of the survey, very few questionnaires were

completed in their entirety. Therefore even a partially completed survey was still considered a

valid response. Between the first and third mail out of the questionnaire, fifteen envelopes were returned as undeliverable. In addition, three companies used the return envelopes to inform the researcher that they thought they did not meet the research definition of a log building producer, explaining they produced "Lindal style" homes which are not similar to log buildings. One response was received from a company that stated it was "out of business in 2000" and one from a company notifying us that we had sent letters to their head office as well as their manufacturing site. As a result, the sample frame was reduced by 20 to a refined sample frame size of 171 companies (See Appendix 6). The refined sample frame size was confirmed by Brian Lloyd, Executive Council member of the LBIA (pers. comm. 8 Jan. 2004) as an accurate estimate of the industry size. The second mail out contacted all non-respondents of the first mail out resulting in 138 mailed surveys. Five respondents returned the survey unanswered with responses ranging from "not interested in participating" to a handwritten messages stating "it was none of your damned business to ask these types of detailed questions". The sample size for the study was 42.

4.1.2   Survey response rate calculation

The survey response rate (RR) (Equation 1) was calculated counting all valid survey responses received from the refined sample frame from each mail out:

Equation 1. Survey response rate calculation

$$ RR = \frac{\text{Valid responses for mail out phase}}{\text{Refined sample frame} - \text{Valid responses from earlier mail out}} $$

The overall response rate (ORR) (Equation 2) determines what proportion of the refined sample frame answered the survey:

Equation 2. Overall response rate calculation

$$ORR = \frac{\text{Total number of valid survey responses}}{\text{Refined sample frame}}$$

The RR for each mail out and ORR is provided in Table 3.

Table 3. Mail survey response rates

	Number of surveys sent	Number of valid survey responses	Response rate (%)
First mailing	171	32	18.7
Second mailing	138	10	7.3
Overall		42	24.6

The range of acceptable response rates for industry mail surveys varies widely. A response rate of greater than 10% is suitable for statistical analysis but a 20% to 30% response rate is more acceptable (Miller, 1977; Salant and Dillman, 1994; Babbie, 2001). The ORR for this study was 24.6% (Table 3).

4.1.3 Non-response bias

Inherent to research involving mail surveys is the issue of systematic error. Several types of systematic error occur but non-response bias is of interest in this survey. Non-response bias is important because it determines whether there is a significant difference between the portions of the population that did not respond to the survey and those that did (Salant and Dillman, 1994). A method to test for non-response bias when utilizing a multistage mail survey format involves a two-tailed t-test to compare respondent data of the initial mail out to the second mail out. The variables selected to test for non-response bias between the two groups were business age, number of full time employees and volume of fibre purchased. These variables were selected as they are central to the research objective of assessing the state of the industry. In Appendix 7, t

test results are presented for the three groups. In all cases, there are no significant differences at an alpha level of 0.05 (Table 4).

Table 4. Variable averages and t test results

Variable tested	First mail out	Second mail out	T value	T critical	P value
Business age (years)	15.44	19.20	-1.033	2.160	0.32
Number of full time employees	9.96	8.29	0.394	2.179	0.70
Volume of fibre purchased (m³)	1526.33	2572.50	-0.641	2.571	0.55

The acceptable response level and non-response bias calculation supporting the null hypothesis indicate inferences from the research results can be made on the BC log home manufacturing industry population (Miller, 1977; Babbie, 2000).

4.2 PRODUCTION AND FINANCIAL DATA

The initial survey question asked respondents to report the age of their business in years and determined that a majority of respondents (75.60%) had been operating for over ten years (Figure 3).
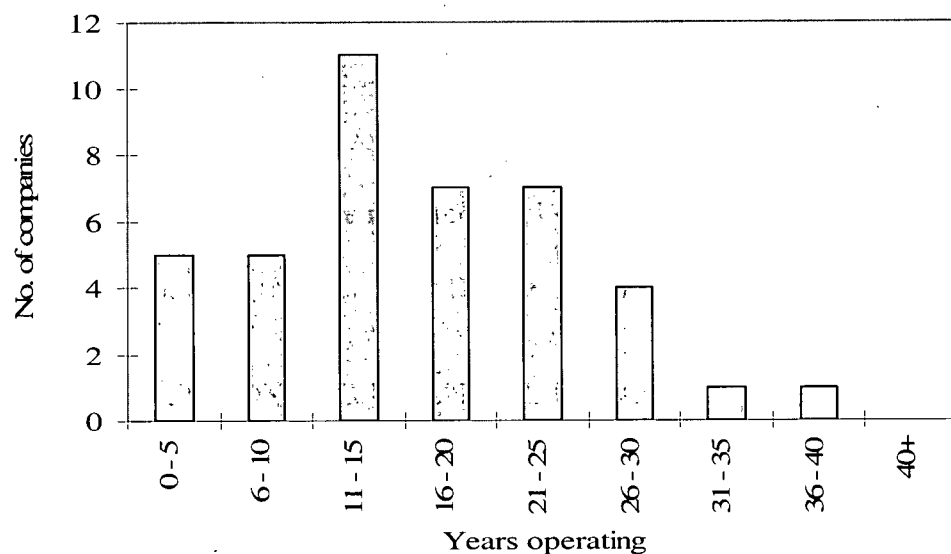
Figure 3. Distribution of log home manufacturing companies by operating age.

The average company age was 16.3 years and the median age was 15.0 years.

When respondents were asked to identify their main manufacturing process used to produce their product lines, hand crafted production methods were much more frequently compared to machine milled production methods (Table 5).

Table 5. Distribution by processing method

Processing method	Percent of total response (%)
Hand crafted	90.2
Machine milled	9.8
Total	100.0

Several common product lines are marketed by the industry. Respondents were provided six researcher and one respondent specified product categories to indicate the breadth of the product lines (See Appendix 8 for product category list and definitions). Table 6 summarizes the frequency of product category selection by thirty-eight respondents.

Table 6. Frequency of product category selection by respondents

Product category	% of respondents	
Custom log home not to lock up	89.47%	
Custom log home to lock up	28.95%	
Multiple unit dwelling	13.16%	
Pre-designed log home (<2000 sq.ft. total)	39.47%	
Pre-designed log home (>2000 sq.ft. total)	36.84%	
Commercial buildings	57.89%	
Other, please specify (see A to C below)	42.10%	
A Log & Timber frame		2.63%
B Timber frame		21.05%
C Post and Beam		18.42%

The custom log home not to lock up was the most frequent selected product category followed by commercial buildings. In Table 6, the Other category was reported frequently and is further broken down into subcategories A to C to show composition of product category total.

In assessing the current status of an industry, it is important to include production levels, sales, materials consumed, markets and employment levels. Table 7 summarizes 26 respondents data on number of units sold, average unit price and size, and average log use for five of the seven product categories as well as the product category total value.

Table 7. Consolidated production and financial results by product category

Product category	Number of units sold	Average unit price ($)	Average unit size (sq. ft.)	Average log use (m³/unit)	Category value ($,000)
Custom log home not to lock up	138	71,107.34	1566	79	9,812.8
Custom log home to lock up	9	282,222.22	3322	155	2,540.0
Pre-designed log home (<2000 sq. ft.)	58	29,067.31	1884	81	1,685.9
Pre-designed log home (>2000 sq. ft.)	94	73,780.14	2793	128	6,935.3
Other (timber frame/post & beam)	51	81,931.82	2197	60	4,178.5
Unclassified	29	98,863.64	1794	95	2,867.0
Total/Weighted average	379	73,930.39	2063	92	28,019.6

A sixth product category, Unclassified is included in Table 7 to report sales and fibre use data recorded by respondents who did not specify a product category. Respondent sold 379 units with a weighted average sales price per unit of over $73,900 and total sales of over $28 million. Respondents, on average, manufactured 14.58 units resulting in $1,077,000 in sales per company. The custom log home not to lock up product category contributed 35.02% to the total sales value (Table 7). Pre-designed log homes greater than 2000 square feet ranked second in unit production and proportion of total product category value (24.75%) (Table 7). The remaining four product categories account for less than 38.76% of unit production, but greater than 40.22% total product category value.

Figure 4 uses data from Table 7 to calculate the average sales value per cubic metre by product category.
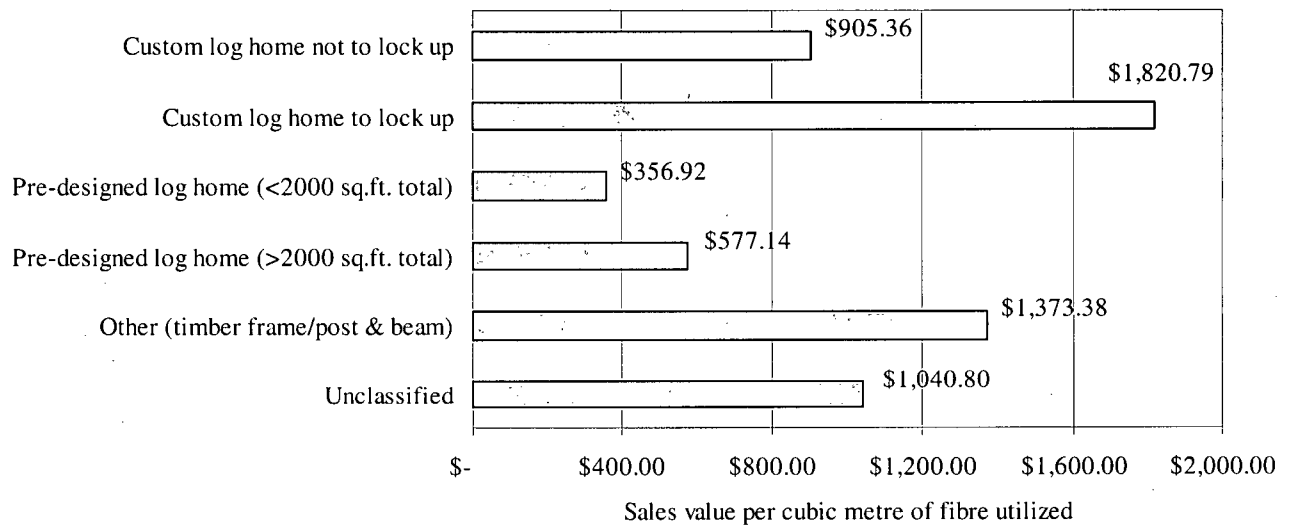
Figure 4. Average sales value per cubic metre by product category.

The weighted average sales value per cubic metre for all product categories was $835.11.

Respondents were asked to report gross company sales for 2002 in one of eight possible categories. The answers displayed a bimodal distribution with the median sales per year falling within the $500,000 to $749,999 category (Figure 5).
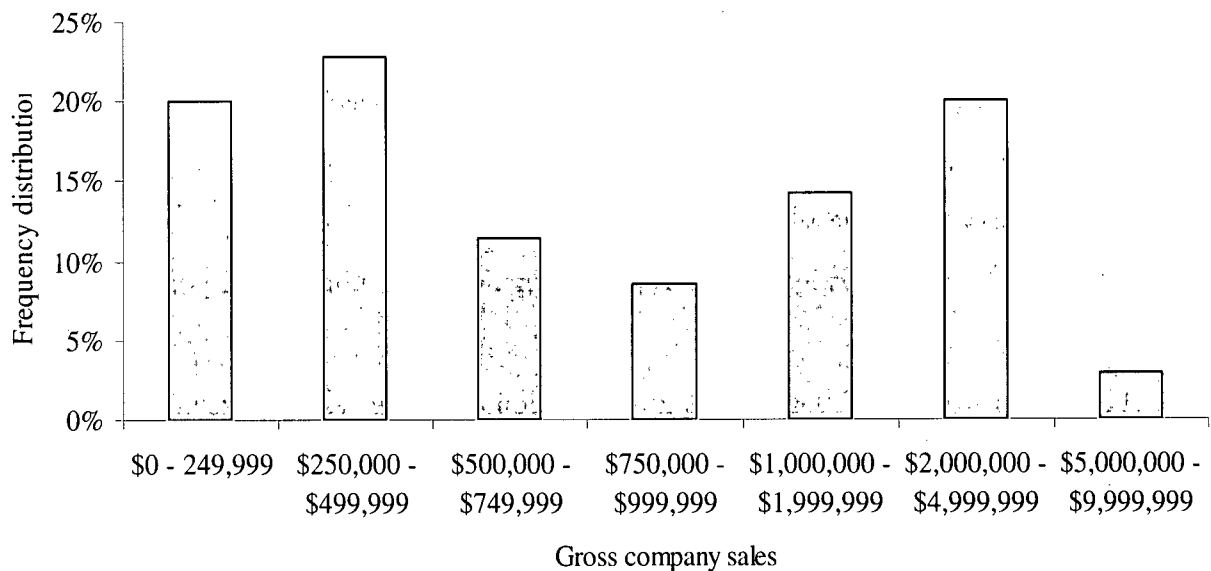
Figure 5. Distribution of gross company sales.

Respondents were then asked to report the percent of gross company sales and sales trends over the last three years in seven global market areas. Figure 6 indicates the distribution of sales in seven market areas.
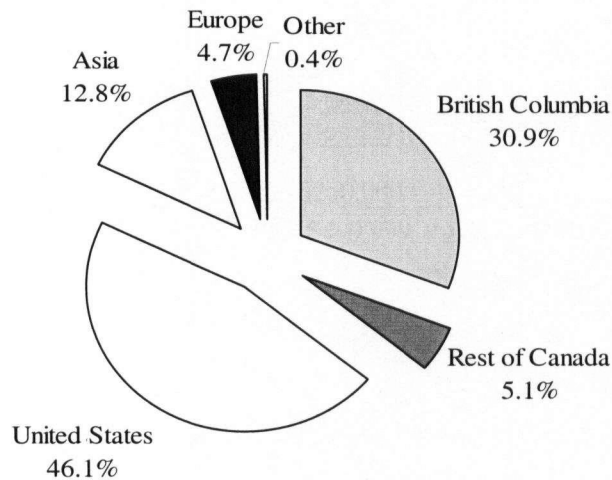
Figure 6. Distribution of sales by market area.

Greater than 82% of log home sales value was completed within North America. The US was the main export destination, with 46.1% of sales (Figure 6) and the strongest increasing sales trend from 1999 to 2002. The rest of Canada and Asian markets also experienced increasing sales trends over this time period, while Europe, Other and British Columbia experienced decreasing sales trends.

Respondents were asked to report the number of full time, part time and contract workers employed at their places of business in 2002. Figure 7 summarizes the mean number of employees by employee type with 95% confidence intervals, and median values were calculated.
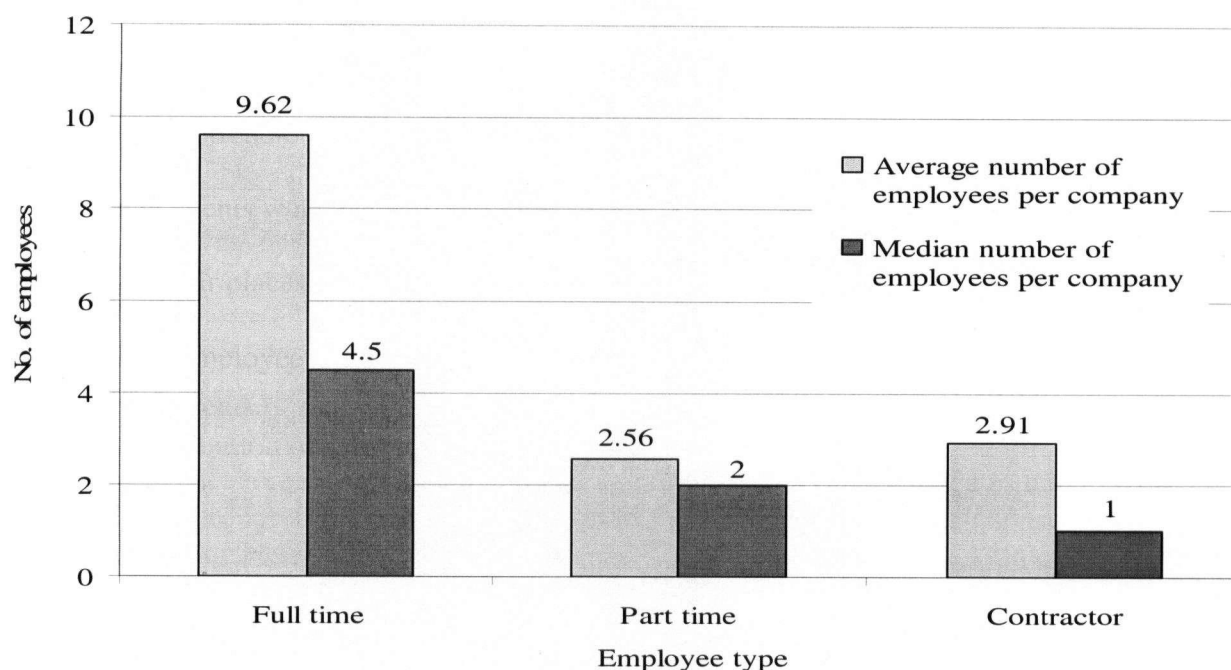
Figure 7. Number of employees by employee type per company

On average, each respondent maintained 15 employees broken down into 9.6 full time, 2.5 part time and 2.9 contract positions.

Respondents were asked to report the 2002 average gross annual salary of their full time employees minus benefits. The mean and median values were calculated based upon 26 respondents resulting in a gross annual salary of $37,076.92 and a median value of $35,000.

4.3   FIBRE SUPPLY CHARACTERISTICS

On a map of BC with the Ministry of Forest's old six forest region system delineated[6], respondents were asked to place a check mark in the forest region where their manufacturing centre was located. Manufacturers from the Vancouver and Kamloops forest regions returned a majority of the survey responses (71.05%) with little or no response from operators in the Prince George and Prince Rupert forest regions (Figure 8).

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[6] On April 1, 2003, the Ministry of Forests changed the forest region boundaries within the Province of British Columbia by amalgamating six regions into three. Research data is presented using the six forest region system.
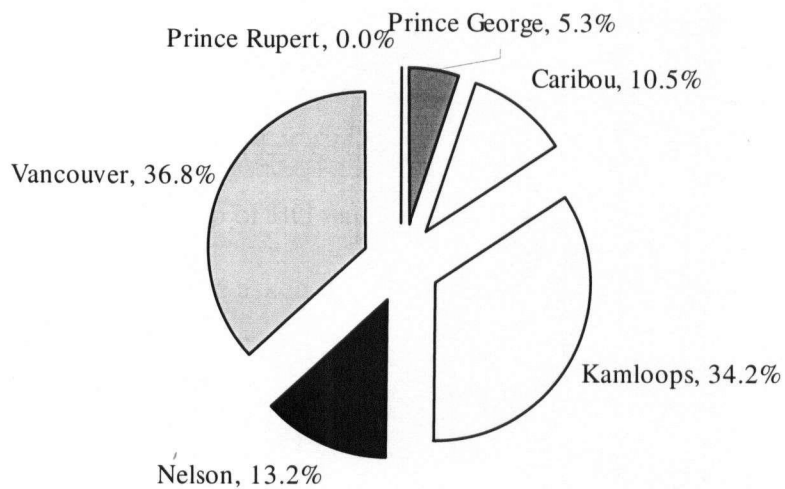
Figure 8. Distribution of respondents by forest region.

Response from these regions was strong as a majority of the industry is located within these two areas. On the same map, respondents were also asked to report the approximate percentage of their total log consumption sourced from each forest region. Figure 9 reports the distribution of fibre consumption by forest region.
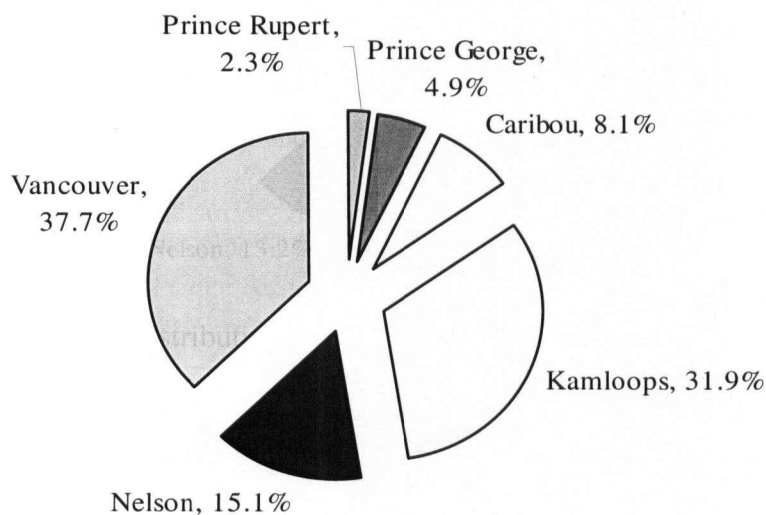
Figure 9. Distribution of fibre consumption by forest region.

The southern half of the province, which includes the Vancouver, Kamloops and Nelson forest regions, provided 84.71% of total fibre purchased.

Log home manufacturers need to source material from many areas in the province based on the product demand of their clients. This leads to fibre purchases from forest regions outside of their home forest region. The cross forest region fibre purchasing distribution (Table 8) was calculated based on the proportional distribution of log purchases by 34 respondents in five of the six forest regions. The left hand column represents the home forest region where the log home manufacturers' facilities operate and the top row indicates the forest region from which fibre was purchased. The far right hand column is the number of respondents answering the question from each forest region.

Table 8. Cross forest region purchasing distribution

| Home region | Purchasing region | | | | | | |
	Prince Rupert	Prince George	Caribou	Kamloops	Nelson	Vancouver	Responses
Prince Rupert	N/A	N/A	N/A	N/A	N/A	N/A	0
Prince George	30.00%	70.00%	0.00%	0.00%	0.00%	0.00%	2
Caribou	5.00%	5.00%	45.00%	45.00%	0.00%	0.00%	2
Kamloops	0.91%	0.91%	5.91%	84.09%	5.00%	3.18%	11
Nelson	0.00%	0.00%	5.00%	0.00%	95.00%	0.00%	5
Vancouver	0.00%	0.71%	0.36%	7.14%	0.00%	91.79%	14
Totals	35.91%	76.62%	56.27%	136.23%	100.00%	94.97%	34

Highlighted within the table is the average percent of purchases made by manufacturers from within their home forest region. In each column, but not highlighted is the average percent of purchases by respondents outside the forest region. Each column was totalled and reports the forest region's fibre balance. A score of 100% means the forest region's internal fibre requirements for respondents equalled the total amount of fibre purchased within the forest region by all respondents; a score above 100% indicates a flow of fibre out of the forest region. The Kamloops forest region experienced the highest flow of fibre out of the forest region while four of the remaining forest regions had a fairly balanced fibre flow or flow into the region.

There were no respondents from the Prince Rupert forest region, but fibre purchases were made from sources outside of this forest region.

Respondents were asked to report the number of log suppliers utilized in 2002. The average number of suppliers per company was 7.0, with a median value of 3.0. The mean number of suppliers per company, with 95% confidence intervals and median values, were calculated for respondents from each forest region (Figure 10).
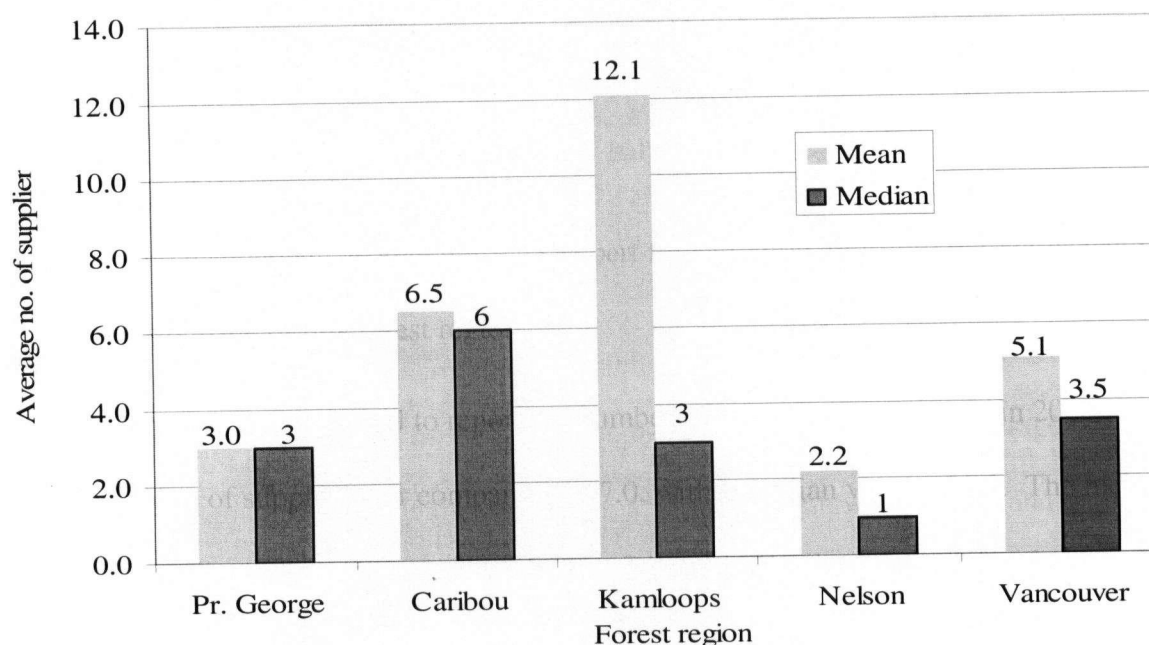
Figure 10. Number of log suppliers per company by forest region

In all forest regions, multiple log suppliers were required to meet manufacturer's production requirements. Respondents from the Kamloops forest region required the highest average number of log suppliers per company (12.1), and the Nelson and Prince George forest regions respondents the fewest log suppliers.

Fibre is secured by the log home manufacturing industry from five common sources: the Small Business Forest Enterprise Program, Broker/Wholesalers, Logging company dryland

sortyards, and Specialty/Auction dryland sortyards and private land owners (respondent specified). The average distribution of fibre purchases by source based upon 34 responses is reported in Figure 11 below.
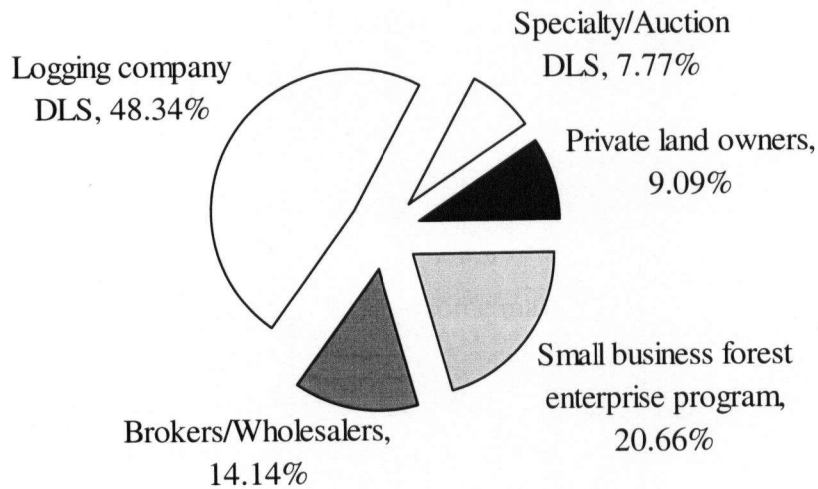
Figure 11. Distribution of fibre purchases by source

A majority of fibre is sourced through logging company's dryland sorts and the Ministry of Forests' Small Business Forest Enterprise Program. Log brokers and wholesalers, private sellers and specialty auction dryland sorts individually do not supply much fibre to the log home manufacturing industry but together provide 31.00%.

The cost of fibre to construct log buildings varies mostly due to the species utilized. The total volume of fibre consumed, average volume per response and average delivered to the manufacturing site price per cubic metre for the five most common species[7] is reported based on 75 responses submitted by 33 respondents (Table 9).

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[7] For simplicity, all tree species identified as Pine were grouped into one category: Pine (*Pinus* spp). This practice was also followed for tree species identified as Spruce (*Picea* spp.) and Cedar (*Thuja* spp. and *Chamaecyparis* spp): Spruce and Cedar/Cypress. Tree species identified as Douglas fir and Larch (*Larix* spp.) were grouped into another category, Douglas fir/Larch. Tree species identified as Hemlock (*Tsuga* spp.) and all true firs (*Abies* spp.) were grouped in a final category: Hemlock/Balsam.

Table 9. Fibre consumption frequency, price and total value by species

Species	Percent of total responses (%)	Total volume consumed (m³)	Percent of total volume (%)	Average volume/ response (m³)	Average delivered log price ($/m³)	Species value ($,000)
Pine	17.33	9,045	16.49	702	114.42	1,043
Spruce	18.67	12,640	22.85	903	125.23	1,583
Douglas fir/Larch	36.00	17,489	31.85	653	139.49	2,458
Cedar/Cypress	28.00	15,945	28.82	759	214.34	3,418
Total/Weighted average	100.00	55,119	100.00	1723	153.67	8,502

A total of 55,119 m³ of fibre was consumed worth approximately $8.5 million. The average volume of fibre consumed per respondent was 1723 m³ and a median value of 1000 m³. The weighted average delivered fibre price was $153.67 per cubic metre. No responses were recorded for the Hemlock/Balsam category.

To clarify further the types of fibre that the log home manufacturing industry purchases, respondents were asked to report the top three species they preferred to purchase and the required minimum and maximum size ranges. The frequency of 86 responses is ranked by most preferred species, with average minimum and maximum size ranges also presented in Table 10.

Table 10. Log species and size preferences

Species	Percent of responses	Top min. (cm.)	Top max. (cm.)	Bottom min. (cm.)	Bottom max. (cm.)	Length min. (m)	Length max. (m)
Douglas fir/Larch	33.72	29.6	32.5	43.9	52.3	13.0	16.0
Cedar/Cypress	30.23	29.0	34.0	47.0	51.8	12.2	16.5
Pine	18.61	27.9	30.5	42.9	56.4	11.6	15.5
Spruce	17.44	27.7	30.0	41.7	45.7	12.2	15.2

4.4   CURRENT METHODS OF ASSESSING LOG PURCHASES

Respondents estimated the average number of hours per week spent sourcing fibre was

8.0 hours with a median value of 5.0. Part of this time was spent inspecting logs with the most

common log inspection methods visual inspections of all logs (62.16%), visual inspection of

some logs (24.32%) and Other practices (5.41%) which included using specification sheets by

third party purchasers and log grading systems. Even though a majority of fibre purchased was

inspected thoroughly, on average 9.1% did not meet their quality standards once delivered to

their manufacturing sites. The most common method used to deal with this substandard fibre

was to buck out defect and utilize log elsewhere in the building (Figure 12).
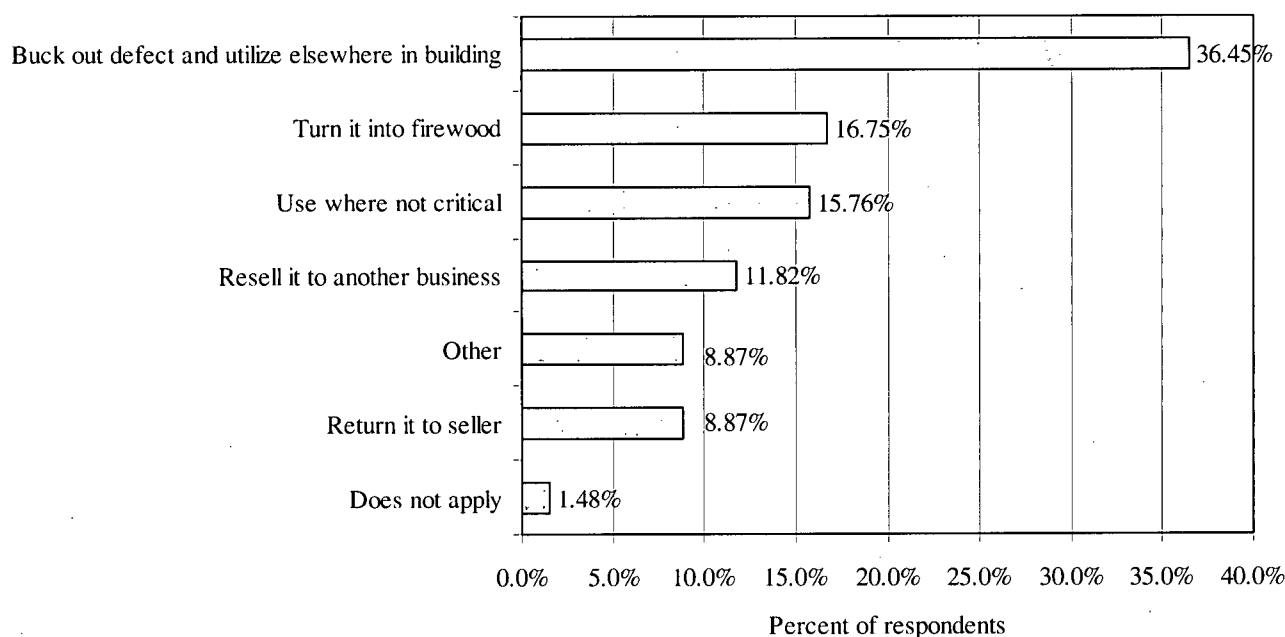
Figure 12. Distribution of methods to deal with substandard fibre once delivered.

Log home manufactures are willing to operate with logs that contain some defect as long

as the offending material can be removed or used in a non-critical part of log homes.   But if the

logs have too much defect, they are twice as likely to end up as firewood than to be returned to

the log supplier, likely meaning once a log has reached the manufacturing site it does not leave.

35

Along with meeting minimum size limits, physical characteristics of fibre purchased is important to log home builders. Respondents were asked to rate seventeen physical characteristic of logs on a scale of 1 to 5, with 1 being a not at all important characteristic and 5 being an extremely important log characteristic influencing their buying decisions. The mean for each characteristic was calculated and then ranked from extremely important to not at all important (Figure 13).

Relative importance

1 = Not at all important   5 = Extremely important

Log characteristic	Value
Proper log species	4.76
Lack of spiral grain	4.58
Free from any type of rot	4.54
Log straightness	4.32
Free from any mechanical damage	4.24
Log dimensions on target	3.89
Free from any splits	3.74
Presence of loose knots	3.63
Greater than 6 rings per in.	3.57
Free from any staining of the wood	3.30
Free from stump pull	3.28
No knots greater than 5 cm.	3.26
Logs almost perfectly cylindrical	3.14
Logs aged greater than 6 months	2.89
Even distribution of small knots	2.86
Light coloured wood	2.78
Logs freshly cut	2.62

Figure 13. Rank and mean score of physical log characteristics important to log home builders.

A one way analysis of variance was completed (alpha level of 0.05) to determine if the log

characteristics means were significantly different from each other (Table 11)

Table 11. Anova for means of log characteristics

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	272.75	16	17.047	14.039	2E-32	1.6601
Within Groups	739.47	609	1.2142			
Total	1012.2	625				

The ANOVA results reject the null hypothesis with a significant difference between

variable means. A Scheffe test was completed to determine which of the log characteristics with

the lowest mean values were significantly different from the remainder of the log characteristics

until the highest value was reached. The lowest eight log characteristics, from logs freshly cut to

free from any staining of the wood were significantly different from the remaining nine log

characteristics with higher mean scores, greater than 6 rings per inch to proper log species.

When asked to record other log characteristics important to look for during the

purchasing process, respondents most often noted insect damage, wind shake and character

marks. When log home manufacturers purchase fibre from a potential seller, eight key issues are

important in the decision process and relate to both fibre and service qualities. These issues

when rated on a scale of 1 to 5 with 1 being not an important characteristic and 5 being a very

important characteristic influencing their buying decisions resulted in the following ranking

based on average scores, highest to lowest (Figure 14).
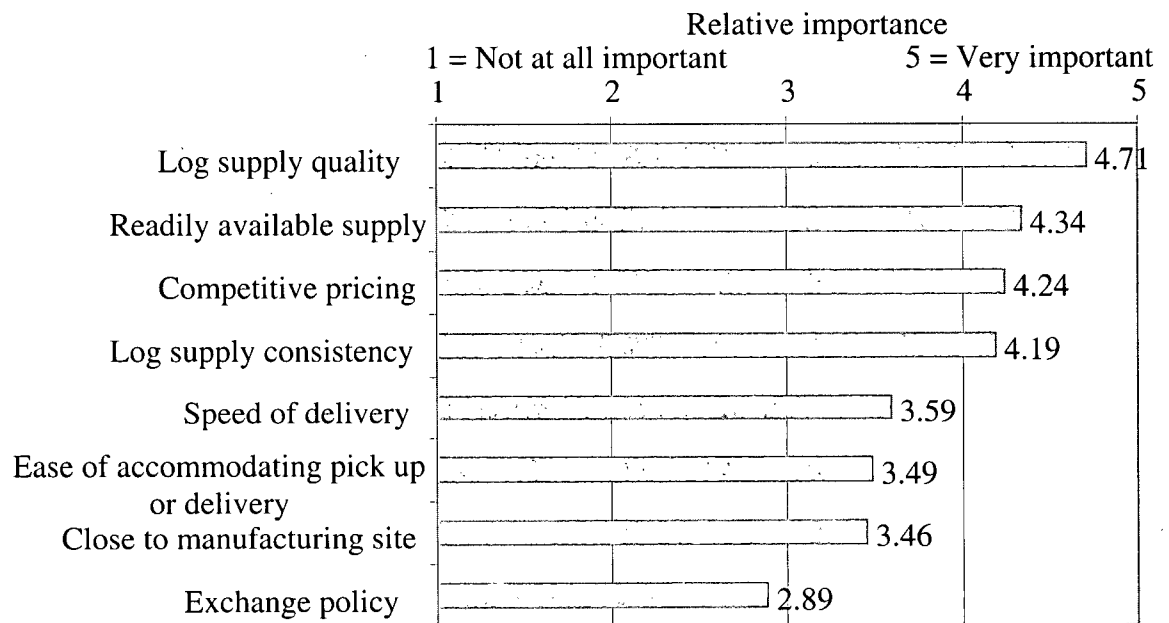
Figure 14. Rank and mean score of log seller's characteristics.

Log supply quality was the most important issue related to purchasing decisions followed closely by readily available supply and competitive pricing. The fibre supplier's exchange policy and location in relation to the manufacturing site were the lowest rated characteristics. However, all characteristics, except the exchange policy, rated above the midpoint of three (3), likely meaning all issues may affect a purchasing decision. A one way analysis of variance was completed (alpha level of 0.05) to determine if the log seller's characteristics mean values were significantly different from each other (Table 12).

Table 12. ANOVA for means of log seller's characteristics

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	94.122	7	13.446	13.839	2E-15	2.0412
Within Groups	281.77	290	0.9716			
Total	375.9	297				

The null hypothesis was rejected based upon the ANOVA calculations. A Scheffe test was completed to determine which of the log seller's characteristics with the lowest mean value were significantly different from the remainder. The lowest five issues in Figure 14, exchange policy to log supply consistency, were significantly different from the top three issues, competitive pricing, readily available supply and log supply quality. However, the characteristics ranked third through seventh in importance were not significantly different indicating a log supplier's exchange policy may not affect purchasing decisions, but readily available supply and log supply quality likely will.

4.5   ALTERNATE SOURCES OF FIBRE SUPPLY

Respondents were asked to rate their company's business philosophies when presented with three alternative fibre sources in comparison to high quality, old growth fibre as a building material. Old growth fibre was defined in this study as trees with narrow growth rings and second growth as trees with wide growth rings, ignoring the possibility trees being virgin timber. This definition was used instead of Ministry of Forest Inventory Branch's classification of mature timber, trees 121 years old and greater, because most manufacturers are more concerned with the number of rings per inch of tree diameter than tree age. The alternative fibre sources provided in the study were second growth, fire killed and insect killed timber. Respondents reported their level of agreement to three researcher supplied statements that pertained to these alternative fibre sources as potential building material on a scale of 1 to 5, with 1 being strongly agree to the statement and 5 being strongly disagree. Figure 15 summarizes the mean results for each statement with confidence intervals.
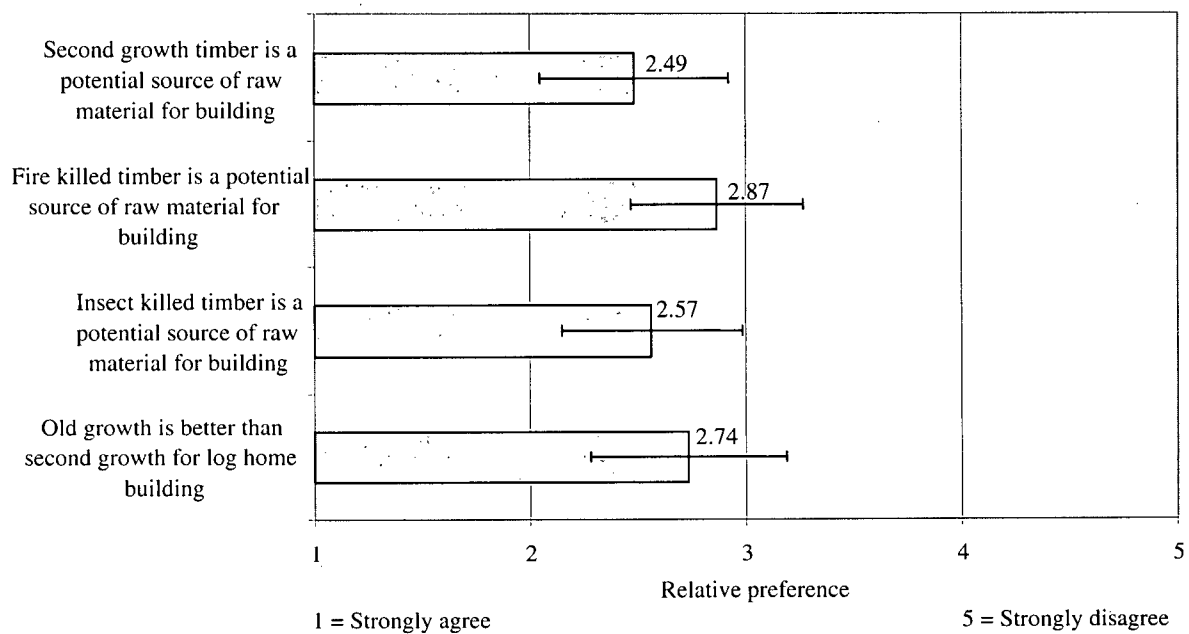
Figure 15. Mean scores of alternative fibre suitability as a building material.

Overall, log home manufacturers somewhat agreed all three alternatives were potential sources of fibre supply with the order of preference being second growth, insect killed and fire killed. However, when the statement means with 95% confidence intervals are tested against the neutral point of three, only second growth timber (2.49 ± 0.44) and insect killed timber (2.57 ± 0.42) are significantly different from the neutral point, while fire killed timber (2.87 ± 0.40) is not. A fourth statement was included in the survey question to compare manufacturers' preference for old growth timber over second growth timber (Figure 15). The statement mean with a 95% confidence interval and median value computed resulted in an almost neutral point response (2.74 ± 0.45) not significantly different from three.

Twenty-four out of a possible forty-one respondents (58.5%) provided data on their use of alternative fibre sources indicating its widespread use as a building material. Table 13 reports by alternative fibre source category: frequency of responses, volume purchased, average delivered price per cubic metre, year the product was first used and the fibre purchasing trend for 2002.

Table 13. Volume purchased and average delivered price of alternative fibre sources for 2002

Alternative fibre type	Volume purchased (m3)	Average delivered price ($/m3)
Insect killed	15,480	100.38
Fire killed	350	N/A [a]
Second growth	10,543	169.23
Total/Weighted average	26,373	127.60

[a] average delivered price of fire killed timber withheld to prevent the release of respondent specific data

The total value of the alternative fibre sources purchased by respondents was $3.3 million with a weighted average delivered price per cubic metre of $127.60. Second growth timber has been used for almost two decades while the use of fire and insect killed is relatively recent. The volume of alternative fibre purchased represents 47.7% of the total volume of fibre (55,119 m^3) purchased by respondents.

In order to determine the market price of the alternative fibre sources, respondents were asked to report the discount required before they would consider purchasing alternative fibre sources as a substitute to old growth timber as a building material. Figure 16 summarizes the three alternative fibre sources average discounts.
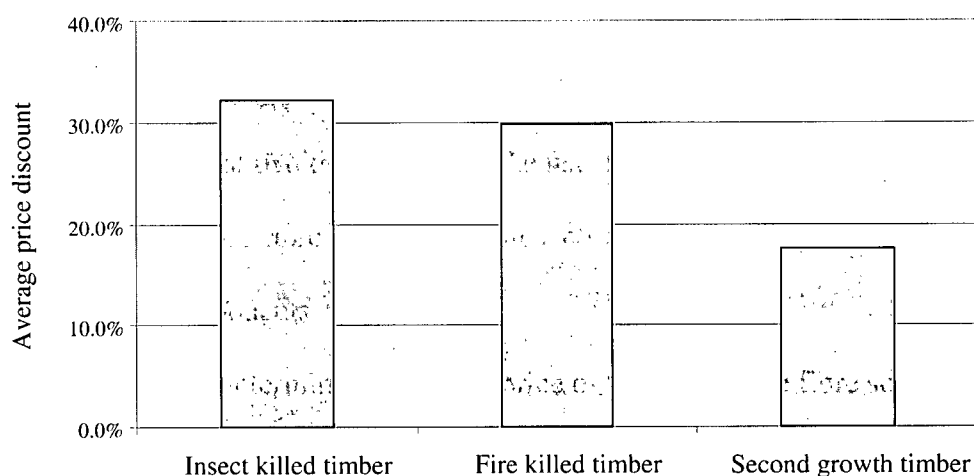
Figure 16. Average discount required for alternative fibre source.

The discount necessary for insect killed timber was the largest at 32.3%, followed by fire killed timber at 29.9% and the lowest for second growth timber at 17.5%.

In order to confirm that a discount was made, the average delivered price of insect killed timber was compared to the average delivered price of Pine and second growth timber versus Cedar/Cypress prices (Figure 17)[8].
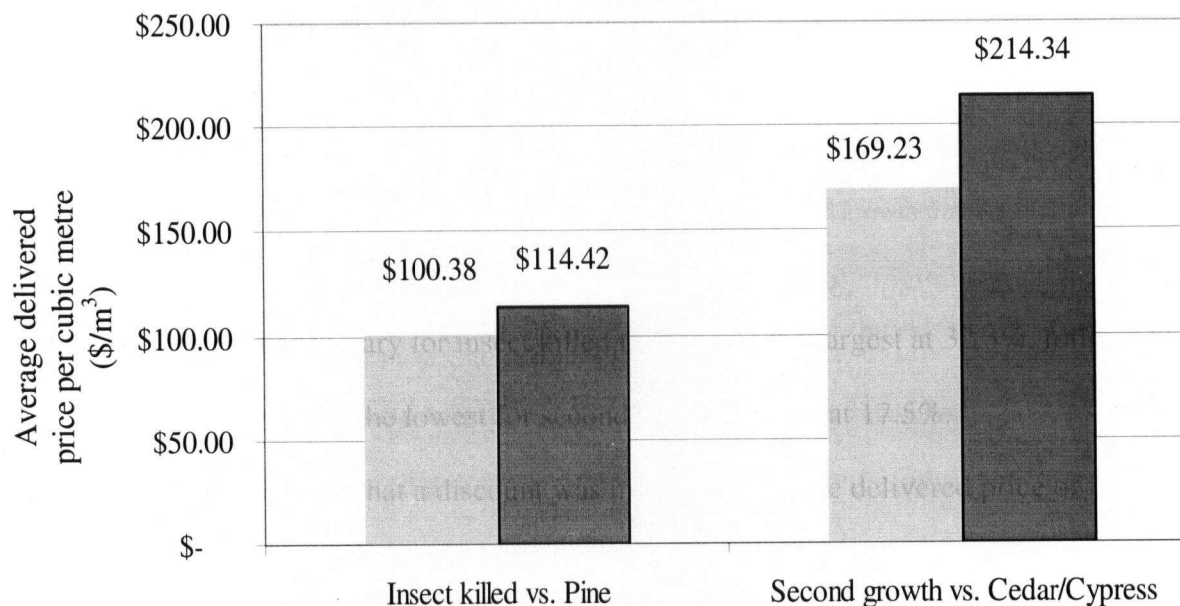
Figure 17. Average delivered price of alternative fibre source versus selected species

The discount rate (D) for the comparison was calculated as follows:

Equation 3. Discount rate calculation

$$D = \frac{\text{Species average delivered price} - \text{alternative fibre average delivered price}}{\text{Species average delivered price}} \times 100$$

The calculated discount rate was 12.3% for Insect killed and 21.1% for Second growth. The reported discount rates for these two categories were 32.3% and 17.5%, respectively.

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[8] This comparison was recommended by Robert Savignac of the ILBA (pers. comm., 17 Nov. 2003).

Ten of the possible seventeen respondents followed the filter pattern in the mail survey and reported why they did not utilize alternative fibre sources. Respondents were asked to place a check mark beside as many of the nine categories identifying why alternative fibre sources were not used. A total of 39 check marks were recorded and ranked by the frequency of responses from highest to lowest (Table 15).

Table 14. Frequency and ranking of reasons for non use of alternative fibre sources

Category	% of total responses
Perceived quality problems	25.64
Lack of demand	20.51
Aesthetics	15.38
Perceived durability	12.82
Material not available	12.82
Workability	10.26
Safety considerations	2.57
Total	100.00

There were no responses to "Difficult to handle" and respondents' specified answers. Six of the remaining categories were related to customer and builder preference for not utilizing the material and totalled 87.18%. The "Material not available" category was included to determine the level of interest for the material by non-users that could not secure a supply and tied for the third most common response with 12.82%.

4.6 RESOLVING FIBRE SUPPLY ISSUES

Respondents were asked to indicate their level of agreement to twelve researcher supplied statements pertaining to their company's fibre supply issues on a scale of 1 to 5, with 1 being strongly agree to the statement and 5 being strongly disagree with the statement. Table 15 summarizes statement means with 95% confidence intervals and ranks statements from most strongly agree to most strongly disagree.

Table 15. Rank and mean scores of company's fibre supply issues

Statement	Mean	CI
My suppliers are trying to provide a product suited to my business	2.15	± 0.26*
Paying a premium for fibre that meets all my company's log quality specifications is worthwhile	2.38	± 0.38*
The dimensions of logs we require is easily available	2.49	± 0.43*
I am happy with the service I receive when purchasing logs directly from my suppliers	2.50	± 0.27*
I would purchase logs from a government run log sortyard	2.51	± 0.35*
A steady supply of high quality fibre is difficult to find	2.65	± 0.42
The quality of logs we require are easily available	2.72	± 0.43
Having one supplier provide me with all my raw material needs would benefit my company	2.98	± 0.36
The logs we require are available at a fair price	3.35	± 0.31*
Large forestry companies have a good understanding of the BC log home manufacturing industry	3.56	± 0.34*
Large forest companies would readily supply logs to my company	3.62	± 0.36*
The provincial government has a good understanding of the BC log home manufacturing industry	3.85	± 0.34*

* denotes statement is significantly different from the midpoint of three (alpha level = 0.05)

Each mean and 95% confidence interval was tested against a neutral point of three to determine which were significantly different than three, the point on the scale that represents an undecided attitude, and indicated with an asterisk (*).

Respondents were asked to indicate their level of agreement to thirteen researcher supplied statements on ways to resolve their company's fibre supply issues on a scale of 1 to 5, with 1 being strongly agree and 5 being strongly disagree. Table 16 summarizes statements means with 95% confidence intervals with statements ranked from most strongly agree to most strongly disagree.

Table 16. Rank and mean scores of ways to resolve fibre supply issues

I support.....	Mean	CI
export restrictions on fibre meeting log home manufacturers size and quality requirements	1.82	± 0.35*
redistributing the weighting system in current small business sales to favour log home manufacturers more	1.98	± 0.39*
forest region specific quotas to sell house logs to log home manufacturers	2.00	± 0.33*
a new category of small business timber sale exclusive to the log home manufacturing industry	2.12	± 0.41*
woodlot like tenures exclusive to value added manufacturing companies to provide a dedicated fibre supply	2.21	± 0.41*
forest company specific quotas to sell house logs to log home manufacturers	2.27	± 0.36*
forming business relationships with integrated forest companies in order to secure a dedicated fibre supply	2.43	± 0.37*
removing restrictions on logs imported into the province for the purpose of value added manufacturing	2.45	± 0.32*
governmental funding of specialty log sortyards in several locations throughout the province	2.58	± 0.42
changing the current provincial log grading system to include a category specifically for house logs	2.69	± 0.45
forming buying cooperatives to improve buying power	2.75	± 0.38
forming business relationships with First Nations in order to secure a dedicated fibre supply	2.76	± 0.37
using fibre facilitators through log home building associations to secure fibre for my company	2.78	± 0.39

* denotes statement is significantly different from the midpoint of three (alpha level = 0.05)

Each statement mean and 95% confidence interval was tested against a neutral point of three to determine which were significantly different than three, the point on the scale that represents an undecided attitude, and indicated with an asterisk (*).

4.7 GENERAL QUESTIONS

Respondents were provided a skip pattern if they had not turned down log home orders from potential customers in 2002. If they had turned down orders, they were asked to rank the top three reasons why from a list of nine categories, one which was respondent specified. An arbitrary scoring system of 3, 2, and 1 was assigned for ranks first through third respectively. Figure 18 summarizes each reason for turning down work orders total evaluation points and ranked in order of frequency.
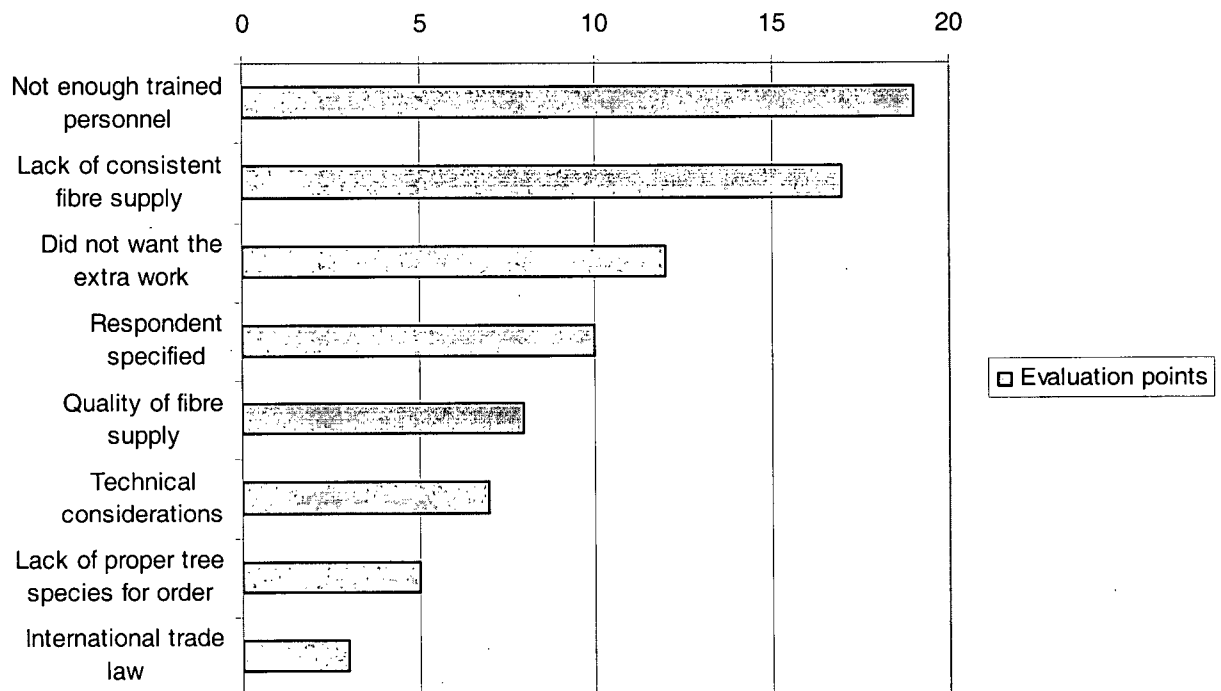
Figure 18. Reasons for turning down work projects

The results show the most limiting factors to the industry were not enough trained personnel followed by lack of consistent fibre supply. The respondent specified answers remarked that fibre did not meet customer expectations and "questionable client knowledge".

These results do somewhat reflect the responses received from an open ended question asking respondents to list the advantages and disadvantages of operating in the BC log home manufacturing industry. Table 17 summarizes the results of the 64 advantages and 46 disadvantages comments recorded with the top three responses for each category based upon percent of total responses with a complete list provided in Appendix 8.

Table 17. Top three advantages and disadvantages of operating in British Columbia

Advantages	Percent of total response (%)	Disadvantages	Percent of total response (%)
1. Quality of fibre	28.13	1. Availability of fibre	23.91
2. Availability of fibre	25.00	1. Cost of fibre	17.39
2. Reputation/marketing of industry worldwide	10.94	3. High shipping cost and constraints	13.04

The industry increased log home package value by including other value added wood products. The frequency of eight researcher specified and a consolidation of seven respondent specified value added wood products categories supplied by log home manufacturers is reported in Figure 19.

% of respondents providing product type

Product	%
Wood framed windows and doors	42.11%
Cedar roofing and siding	36.84%
Interior design additions	31.58%
Solid wood flooring	28.95%
Board and batten siding	26.32%
Patios and decks	26.32%
Wood cabinetry	15.79%
Railings	13.16%
Staircases	13.16%
Other	13.16%
Other siding	10.53%
Picnic tables	5.26%
Log furniture	5.26%
Engineered wood panel flooring	2.63%
Structural Insulated Panel	2.63%

Figure 19. Distribution of companies providing value added wood products by type.

The most common value added products was wood framed windows and door and this was expected since most log home packages in all product categories include these items. The second and third most frequent value added products were cedar roofing and siding and interior design additions.

The final question in the survey provided respondents the opportunity to make additional comments about the log home building industry in BC. Over half of the respondents' comments were about fibre supply challenges and highlighted the following challenges:

- lack of access to high quality fibre from large forest companies and the Small Business Forest Enterprise Program
- strong competition within the industry for fibre
- high fibre costs.
- adversarial business relationships created by some log home builders with log suppliers.
- foreign control of the larger log home manufacturers within the province and their better access to fibre through timber sales.

In addition to the above situation, other issues reported that affected the industry but are not directly related to fibre supply include the following:

- trying to keep government out the way of small business
- governments preference to work with larger companies over smaller companies
- lack of promotion and support of value added wood product producers
- government incentive programs for First Nations organizations and log home builders who cooperate with them
- lack of government interest in developing the industry via training programs

On a positive note, several respondents reported that international markets for log homes were very strong, "almost boundless", and they were very optimistic about the industry's capacity to grow. However, they also noted that orders were turned down on a consistent basis and more employees could be hired but the lack of quality fibre holds companies back. A complete list of comments is provided in Appendix 9.

5   DISCUSSION

Discussion of the research objectives is heavily dependent upon research results and input from industry professionals due to limited amounts of academic literature. The thesis research objectives are:

1. to assess the current state of the BC log home building industry;
2. to identify fibre supply characteristics of the industry; and
3. to investigate the use of alternative fibre supply sources.

Non-normal distribution of research data in favour of larger companies required the presentation of mean and median results in several areas to convey industry characteristics. As well, some survey questions were designed with intentional bias to collect the industry's opinions on fairness of fibre pricing. Fairness of fibre pricing is subjective and out of the scope of this thesis. A majority of responses to these questions were biased in favour of the industry but still recorded in research results.

5.1   THE STATE OF THE BC LOG HOME MANUFACTURING INDUSTRY

The study's findings on industry size, industry characteristics, product lines and attributes, sales results, markets and employment and factors affecting industry performance are described below.

5.1.1   Industry size

The refined sample frame of 171 companies is considered to be an accurate estimate of the industry size. This was the largest survey total ever reported in BC and is 31% greater than the 2000 estimate by Houdek (2001) and 76% greater than the 1999 estimate by Wilson *et al.*,

(2001). The study's population total was larger for three reasons: first, the definition of the research population included companies producing timber frame buildings (approximately five percent of the population); second unlike previous studies, the sample frame included all companies actively advertising their services no matter how small the company; and third, a large number of new companies have entered the industry in the last four years. Approximately 15% of respondents recorded their companies started operating after 1997.

5.1.2 Industry characteristics

The study's expanded population search gathered a proportionally larger number of smaller companies. These companies tend to produce hand crafted log homes and resulted in the greatest recorded disparity of production methods: 90% hand crafted versus 10% machine milled. This is the highest ever recorded but is still consistent with previous surveys (Stennes and Wilson, 1999; Houdek, 2001; Wilson *et al.*, 2001). The preference of hand crafted production methods is due to continued international demand for high quality hand crafted log homes and the extensive machine milled log home industry present in the US and Scandinavia (Westcoast CED, 1999).

Over 80% of respondents have operated more than 10 years which indicates several important industry characteristics: low industry attrition rates, strong product demand to supports existing companies and new entrants, and mature company ownership to cultivate business relationships to ensure dedicated sources of fibre supply. The large number of new entrants suggests the log home manufacturing industry has a large enough market to support them but increased industry size will place even further pressure on fibre supply sources than is currently experienced as these companies mature and increase production rates.

The majority of respondents recorded their manufacturing location in the Vancouver and Kamloops forest regions (Figure 8) and responses to mail surveys from companies in these areas

has been strong in three previous studies. All studies, including this one, report small population sizes and very low response rates for the Prince Rupert, Prince George, Nelson and Caribou forest regions. However, it is worth noting that companies within the Nelson and Caribou forest regions did respond well to this survey, each with greater than 10% of the response total. These two regions have experienced the largest increase in number of companies based on a comparison to 1997 data (Stennes and Wilson, 1999) and correlates to a strong internal demand for log homes reported within these regions (Westcoast CED, 1999).

5.1.3 Product lines and attributes

Several common product lines are marketed by the log home manufacturing industry and most respondents indicated they were capable of producing two or more of the seven product categories listed in the survey. Of these seven product categories, production and financial data was only collected on five. The similarities within these five product categories are best discussed as three groups: custom log homes, pre-designed log homes and timber frame building.

The custom log home category is important to the industry because it generated the highest average sales value per cubic metre because manufacturers were more likely to be responsible for additional project phases and custom design features. The additional phases required may include one or more of the following: development of architectural drawings, building site preparation, product assembly at the building site or subcontracting of additional building trades. Custom log homes are a preferred product because customers can contribute significantly to the building's design. Custom design features are normally built with logs, such as log staircases and log railings, and are services provided by the log home manufacturer. This increased the amount of fibre utilized per unit but the overall effect was positive for the manufacturer as these additional services resulted in above average unit prices (Table 7) and sales value per cubic metre utilized (Figure 4).

The pre-designed log home category was the only category selected by all respondents whose main production process was identified as machine milled. It possessed the greatest unit production tally but contributed proportionally less to total sales value. Machine milled log homes typically have lower production costs and fibre consumption per unit but also lower sales value per cubic metre (Westcoast CED, 1999). The lower average unit price and sales value per cubic metre is attributed to the use of automated profiling machinery, lower quality and smaller sized fibre and less customized building packages.

The timber frame building category (listed as Other in Table 7) has some advantages over other product categories. It generated the second highest sales value per cubic metre (Figure 5) because substantially less fibre per square foot of building space was utilized (Table 8). This is likely the result of pricing timber frame buildings on a dollar per square foot basis on par with custom log homes but having the advantage of substantially lower fibre and labour inputs per unit. While additional inputs are required for this product category to complete the building shell and partitions, the cost per square foot using conventional construction practices (dimensional lumber) or structural insulated panels is significantly less expensive than solid wood walls.

5.1.4   Company sales per year

Company sales per year data of 38 respondents resulted in bimodal distribution with median results of $500,000 to $749,999. Woodbridge (2003) reported similar findings and noted smaller companies were remaining in the higher value custom log home niche markets, preferring to simplify business operations, while larger companies were expanding product lines and production levels to increase market share in several export areas.

An alternate method to calculate annual sales was through data provided on unit production and value in the mail survey. Larger companies were more willing to provide such data and based on the sales of 26 respondents average annual company sales of $1.1 million was

calculated. This higher annual sales result corresponds with Stennes and Wilson (1999) who
excluded smaller companies in their research methodology.

5.1.5 Markets and employment

The study' results indicate a shift in the traditional markets that have been developed by
the industry. While a vast proportion of sales were again to the US market (Figure 6), the BC
market expanded more than threefold, while the Asian market reduced by almost half and the US
market by a third when compared to Wilson *et al* (2001). The export of 83% to 90% of log
homes reported by Houdek (2000) and Stennes and Wilson (1999), has dropped dramatically to
69% in 2002, indicating contracting export markets in several areas. The US and Asians
markets, are still recovering from economic downturns but both have experienced increased log
home sales trends from 1999 to 2002 (Table 9). Local manufacturers refocused on the BC and
Rest of Canada markets to maintain production levels but expansion is limited as these markets
are mature, less profitable and relatively small on a global scale (Westcoast CED, 1999).

The BC log home manufacturing industry continued to create significant amounts of
employment in 2002. The number of full time equivalent employees per company was less than
reported in Wilson *et al* (2001) but that was expected due to different methodology used (see
Section 1.1.1.). Employment stagnation or reduction may have been experienced from 1999 to
2002 as the median annual full time salary of $35,000 has remained unchanged and labour
reported as a minor disadvantage of operating in the BC log home manufacturing industry. The
employee reduction may account for increased industry size as the new industry entrants may
possibly be the displaced employees starting their own companies.

5.1.6 Factors affecting industry performance

The factors that had the greatest impact on the industry's business performance were
related to fibre supply. The cumulative effect of inconsistent fibre supply, poor fibre quality and

fibre cost exceeded labour and non-production related issues. When focussing on the range of fibre supply issues, inconsistent fibre supply was determined to be the main fibre supply problem, and was self-identified (fibre availability) as the primary disadvantage of operating in the BC log home manufacturing industry with fibre cost and fibre quality ranking in the top four (Table 17). Statistically significant results indicate fibre availability and cost were problems because large forest companies were not readily supplying logs, fibre was unavailable at a fair price and price premiums were necessary to ensure a consistent supply of high quality fibre (Table 15). However, another statistically significant result in Table 15 refutes the above point by reporting respondents had easily available access to suitable fibre in the dimensions required.

Large forest companies are seen as the main source of fibre supply challenges as they control a majority of the fibre flow in the province. In 2002, roughly 80% of the annual allowable cut from public forest lands originated from Tree Farm Licences and Forest Licences controlled by six companies (Ministry of Forests, 2003). The only form of timber tenure available to the log home manufacturers is a Category II timber sale licence. Timber sale licences, which were the primary method of granting timber rights in BC prior to 1947, today represent only 14% of the 2002 annual allowable cut and are allocated on a competitive basis to over 1600 companies (Ministry of Forests, 1997; Ministry of Forests, 2003).

5.2   FIBRE SUPPLY CHARACTERISTICS

By determining the BC log home manufacturing industry's key fibre supply characteristics, another important element is gained to better understand the industry. Discussed here is how sources of fibre, fibre costs, preferred fibre size and quality characteristics and business factors impact the industry's search for secure supplies of high quality fibre. Regarding fibre prices, the perspective of fair log prices is from the log home builders' point of view. Very little academic information exists in this area.

5.2.1 Sources of fibre

Sources of fibre were analyzed in two ways: by forest region and supplier type. While it is obvious some fibre would transfer between coastal and interior forest regions based on production requirements, three conditions were expected: 1) the proportion of fibre purchased by forest region would match the proportion of response by forest region, 2) each region would provide greater than 90% of its internal fibre requirements, and 3) internal plus external manufacturers purchases would equal internal manufacturers requirements. None of the three conditions were met in its entirety and confirms an unbalanced fibre supply situation within the province. No previous data was available on the distribution of fibre purchases by forest region. Fibre consumption distribution by forest region (Figure 9) did follow the ranking as the response distribution (Figure 8), but the proportions between regions differed. Therefore, some forest regions experienced a greater draw on its fibre than others. Most forest regions supplied a majority of their internal fibre requirements (>70%), but few met the research expectation of 90%. The only forest region that met all three requirements, including a balanced fibre purchase/fibre requirement situation, was the Nelson region. The Vancouver forest region was close to meeting all three expectations but few interior respondents noted sourcing fibre from this region and resulted in an unbalanced fibre supply/requirement situation. This was not the case for the remaining three forest regions (Kamloops, Caribou and Prince George) that all possess the same tree species of similar size and quality. Based on the cross forest region fibre purchasing distribution table (Table 8), the Kamloops forest region experienced the greatest fibre demand. On the opposite side of the spectrum, the Caribou forest region experienced the greatest inflow of fibre with a majority sourced from the Kamloops forest region. It is difficult to determine what situations led to these results as all three forest regions have fibre that meet manufacturer's size and quality requirements.

Therefore, the regional fibre balance results are somewhat speculative and can be attributed to the use of percentages and not actual volume reported in returned surveys, three regions with low response rates, but also possibly several business factors. These factors affecting fibre supply in these three forest regions could be adversarial business relationships with internal log suppliers, forest companies not making fibre available, challenges in securing small business sale timber or the lack of specialty dryland sortyards or log auctions. Regional analysis of Questions 25 and 26 may clarify these claims.

Supplier type preference reveals a continued heavily reliance on logging company dryland sortyards to supply fibre. This source is likely preferred because it can provide a readily available supply at most times of the year. This reliance, however, exposes the log home manufacturing industry's vulnerability to external forces that may affect not only fibre quantity, but also quality and price. The Small Business Forest Enterprise Program (currently known as BC Timber Sales) is still not a viable option to supply the industry. All fibre within timber sale contracts successfully bid upon by log home manufacturers does not meet production requirements and captures capital in the harvesting process until sold. Excess fibre is sold to other business or ends up in trading programs but trading incentives are focussed towards large forestry companies. Log auctions, brokers and private timber individually do not surmount to significant amounts of timber individually, but collectively are more important than timber sales. The importance of all five log supplier types indicates that multiple sources of fibre are necessary to ensure adequate production continuity. This situation is best displayed in the Kamloops forest region. The provincial demand for fibre in this region required local manufacturers to utilize the highest average number of log suppliers per company (Figure 10) and to source fibre from all six forest regions (Table 8). Data may have been skewed heavily for this region's analysis as two respondents reported 40 and 50 suppliers; however, they each

purchased greater than 3600 m³. If these two outliers are removed, the average number of

suppliers per respondents in this region was 4.8. Furthermore, the suspicion that manufacturers

in the Caribou forest region have difficulty with fibre flow due to adverse business relationships

is supported since this area recorded the second highest number of suppliers required per

company (Figure 10).

5.2.2   Cost of fibre

High fibre cost continues for the log home manufacturing industry. The 2002 weighted

average delivered log price per cubic metre was significantly higher than rates paid for

comparable fibre purchased by the primary manufacturing industry. As a relatively small open

log market exists in BC, Ministry of Forest Log and Lumber Selling Price System data was used

in the comparison of log prices. Log prices from this system should not be considered entirely

reflective of open log market prices. Comparables of fibre purchased by primary industry would

be peeler logs in the interior and a mix of large "J" and small "H" metric grade logs on the coast

ranging from $80 to $165 per cubic metre for 2002 and 2003 for the four most common tree

species utilized by the log home manufacturing industry (Ministry of Forests, 2004b; Ministry of

Forests, 2004c). On a tree species basis, premiums of $30 to $40 per cubic metre were paid for

Pine, Spruce and Douglas fir and $55 per cubic metre for Cedar. Price premiums on house logs

are prevalent in the US as well, where the strong demand for house logs amongst buyers and

limited supply results in prices almost double the price of logs sent to sawmills (Keegan III *et al*,

2000). The industry preference for Douglas fir and Cedar as a building material (Table 11) will

continue to keep production costs high as these species possess the highest fibre costs. Product

substitution is common with manufacturers utilizing large amounts of lower priced insect killed

and second growth timber as an alternative building material. Still, all fibre used in the log home

manufacturing process had an average price per cubic metre above $100. This means

manufacturers need high sales value per cubic metre (Figure 4) to recoup production costs but limits the type of buyers available who can afford log home products.

5.2.3   Preferred size and quality characteristics of fibre

The average preferred minimum and maximum top diameters, bottom diameters and lengths for each tree species were similar across all species (Table 12). Universal size preference across the industry is beneficial because it simplifies supply chain flow parameters. Log suppliers can process multiple species to the same specification and know several manufacturers throughout the province would be willing to purchase the material. The premiums paid (Section 5.2.2) are therefore not limited to exclusive agreements and paid sometimes on full length logs with the remaining top portion above the minimum top diameter used in other parts of the building, cut for firewood or sold to another business.

Fibre quality characteristics apply to features visible on all four tree species during the log inspection process. Proper log species was the most important quality characteristic noted (Figure 14) and is a valid characteristic considering mixed species use within a single unit is uncommon. If a log of the wrong species is shipped to the log home manufacturing site, it is almost twice more likely to end up as very expensive firewood than be returned to the supplier (Figure 13). Quality characteristics that affect a log's structural integrity, namely spiral grain and rot, are two more important characteristics to manufacturers. However, three- quarters of the physical characteristics listed in the survey were deemed important in the fibre purchasing decision process (Figure 13) and indicates very high quality standards are set before fibre is utilized in log home construction. This may justify the increased fibre price but most manufacturers indicated fibre of the proper quality was readily available to them but just not at a fair price (Table 15). This is confirmed (Table 17) where fibre quality ranked first as an advantage and fibre cost ranked second in disadvantages of operating in the BC log home

manufacturing industry. Therefore, some type of artificial price pressure must exist to inflate log values beyond the market price for high quality fibre destined to log home manufacturers.

5.2.4 Business factors affecting fibre supply

Both the supply and demand sides of the fibre transaction process need to be analyzed to determine what business factors affect fibre supply. Based on results, most log suppliers were doing a good job to provide a product suited to the industry and received a premium for their fibre (Table 15). The availability of high quality fibre at a competitive price played a key role in successful business relationships while customer service factors, such as shipping distance and speed of delivery, were relatively unimportant (Figure 14). This indicates fibre was available but manufacturers had to be willing to pay high prices, transport logs from long distances and accept unfavourable business conditions to get high quality fibre to ensure a consistent production flow. The industry is willing to accept these conditions for three main reasons: 1) to maintain the strong revenue flows created by each cubic metre of fibre manufactured, 2) to ensure the industry's reputation as a world class builder is untarnished, and 3) to increase utilization levels of equipment and employees to reduce overall production costs. The above conditions again point towards the requirement of multiple suppliers to meet production needs. Considering that provincial government and large forest companies supply almost 70% of the industry's fibre, the industry felt that log suppliers do not fully understand its needs and therefore knowingly or unknowingly limit the amount of fibre available (Figure 19).

To resolve these fibre supply issues, the industry widely favoured policy based over business based solutions. The policy based solutions involved mostly regulatory changes, forest region and company quota systems to enforce the sale of fibre and new timber tenures exclusive to the value added industry to increase the availability of fibre (Figure 20). While these changes would benefit the log home manufacturing industry, it is mostly at the expense of primary

manufacturers. Business based solutions populated the lower half of potential methods to resolve fibre supply issues indicating challenges still exist with suppliers and attempts to resolve issues at a business level have been unsuccessful.

5.3 ALTERNATIVE FIBRE SUPPLY SOURCES

The traditional type of fibre to the log home manufacturing industry continued to be old growth timber. The willingness of the industry to utilize non-traditional fibre sources stems from the need for a steady supply of fairly priced high quality fibre that meets exact size requirements. The alternative fibre types deemed as potential sources of building material were insect killed and second growth timber (Figure 16). Large volumes of insect killed and second growth timber were purchased, totalling over 26,000 m^3 and represented 46% of the total fibre purchased by respondents. Its demand is extensive and supply problem already exist causing similar problems experienced by manufacturers that purchase exclusively old growth fibre. Strong demand for alternative fibre sources has increased its weighted average delivered price per cubic metre to within $26 of the weighted average delivered price for all fibre. Insect killed timber was the preferred alternative fibre source and is discussed further below.

5.3.1 Insect killed timber volume and value

The popularity of insect killed timber as a building material for the BC log home manufacturing industry is a recent phenomenon due to the extensive insect outbreak in the BC interior that flooded log markets with sap stained, large diameter Pine since 1999. There are two key reasons why insect killed timber is the preferred alternative fibre source: fibre cost and lack of fibre quality concerns.

The high price for second growth and old growth timber require BC log home manufacturers to utilize the more economical insect killed timber as a building material. The

prices for both fibre types cost 50% more to purchase than insect killed timber. Insect killed timber also costs $14 less per cubic metre than Pine, the lowest priced traditional fibre source.

The two main fibre quality features synonymous with insect killed timber, staining of sapwood and reduced moisture content, are not critical physical characteristics when determining whether fibre is suitable as a building material. When reviewing Figure 14, the list of physical log characteristics important to log home builders, the characteristics that best describe these features were logs free from any staining and logs aged greater than six months. These characteristics ranked tenth and fourteenth, respectively, out of seventeen physical log characteristics.

Insect killed timber is a viable alternative fibre source for the BC log home manufacturing industry due to its low cost and few quality characteristics that impact its choice as a desirable building material. The Montana log home manufacturing industry rapid expansion over the last two decades was mostly fuelled by utilizing insect killed timber. The state's primary forest industry considered insect killed timber to be of little economic value, but it proved to be valuable to the log home manufacturing industry because of its low cost, light weight and excellent final stability (Keegan III *et al.*, 2000). .

5.3.2   Insect killed timber discount rate

The situation where the demand for dead and dry wood for log home construction exceeded supply has also been experienced in the northwest US (Westcoast CED, 1999). Several log home manufacturers noted that insect killed timber was not readily available to them even though they had seen huge inventories at local sawmills (Appendix 9). The strong demand by BC log home manufacturers for insect killed timber has reduced readily available supply and resulted in elevating prices. When comparing the average delivered price of Pine versus insect killed timber to determine that the reported discount required was made (Figure 16), a 20.0%

discrepancy was found. The lack of readily available supply, supply inconsistency and elevated fibre costs of insect killed timber mimic the supply problems present with manufacturers that purchase old growth material exclusively. This indicates that no matter what sources of fibre log home manufacturers attempt to utilize, these fibre supply issues will likely be present.

6   CONCLUSION

The BC log home manufacturing industry is an important part of BC's forest industry adding value to timber through increased processing and high quality workmanship. However, the industry's inability to secure consistent supplies of high quality fibre at what they think is a fair price impacts companies at several levels. To determine these impacts, the thesis investigated: the state of the industry, key fibre supply characteristics and the use of alternative fibre sources.

The key areas to report for the state of the industry for 2002 were number of companies, product attributes, markets and factors affecting industry performance. The industry was substantially larger with a large number of new entrants. These companies greatly reduced average production and financial values in comparison to other studies but suggest market demand for log homes is large enough to support them. Increased industry size will place further pressure on current fibre supply sources than is currently experienced as these new companies mature and increase production rates. The industry has three well defined product segments each possessing unique characteristics. Custom log homes were produced mostly by hand crafted manufacturers and accounted for the majority of industry's total sales. While this product possessed a lower average unit size, it did require more fibre input per unit and craftsmanship resulting in the highest sales value per cubic metre utilized. Pre-designed log homes were produced by mostly machine milled manufacturers, possessed the largest average unit size but required less fibre and craftsmanship and therefore yielded the lowest sales value per cubic metre utilized. The timber frame homes were manufactured by both hand crafted and machine milled

manufacturers. This product recorded the second lowest average unit price but due to very low fibre inputs generated the second highest sales value per cubic metre utilized. Log homes are still built primarily for external markets, mainly the US and Asia, but exports have decreased to 69% of sales. Log home manufacturers see their markets as "almost boundless" but key factors affecting industry performance, fibre availability and cost, make it difficult to exploit

Log home manufacturers required several log suppliers throughout the province to meet production needs. Some felt some log suppliers were not readily supplying fibre and it was unfairly priced. Premiums up to $55 per cubic metre were paid when comparing average delivered prices for fibre paid by log home manufacturers versus log purchase prices paid by sawmills in 2002 and 2003. The Kamloops forest region experienced the greatest demand for fibre requiring local manufacturers to have greatest number of log suppliers in the province. All five log supplier types were active in selling fibre to the industry but logging company dryland sortyards were the primary source. Douglas fir was the preferred species as a building material and cedar the most expensive at over $214.34 per m^3. Log quality is extremely important to the industry and very specific size requirements are partially the result for high fibre prices.

Alternative fibre sources, insect killed and second growth timber, were heavily drawn upon by the log home manufacturing industry and accounted for almost half the fibre reported in the study. Alternative fibre sources were required because the industry's traditional source, old growth timber, was sometimes too costly or difficult to find. Insect killed timber was the most widely used alternative source and its future use as a building material anticipated to increase. However, the industry is already experiencing difficulty sourcing insect killed timber and resulted in increased fibre prices and inconsistent supply which mimic the industry's current fibre supply challenge with old growth timber.

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APPENDIX 1. TAXONOMY OF SECONDARY MANUFACTURED WOOD PRODUCTS

Wood Products

Log Products	Intermediate	Final
Chopsticks	Building/Home Components	Boxes, Bins and Crates
Firewood	Cutstock	Cabinets
House Logs	Doorstock	Coffins
Pilings	Edge Glued Components	Countertops
Poles	Finger-Jointed Stock	Decking
Posts	Furniture Components	Doors
Log homes	Joinery Stock	Fencing
Shakes	Ladder Stock	Finger-Jointed Lumber
Shingles	Laminated Components	Flooring
Treated Pilings	Laminated Stock	Flooring/Engineered
Treated Poles	Metric Stock	Furniture/Commercial
Treated Posts	Moulding, Panel Blanks	Furniture/Household
Novelties	Pallet, Crating Stock	Furniture/Patio
	Medium Density Fibreboard	Furniture/RTA
	Particleboard	Garden Buildings, Products
	Pattern Stock	Laminated Veneer Lumber
	Sawmill Specialty Products	Millwork/Architectural, Custom
	Staircase Components	Medium Density Fibreboard
	Turning Squares	Mouldings
	Window Stock	MSR Lumber
		Oriented Strandboard
		Pallets
		Paneling
		Plywood
		Prefab Buildings and Manufactured Homes
		Siding
		Staircases
		Stakes, Lathe, Strips and Batten
		Structural Laminated Beams
		Treated Lumber
		Trusses
		Turned Wood Products
		Windows
		Wood Novelties

Source: Wilson and Ennis (1993)

Note: In table above, the Primary subsection of the Wood Products category has been removed that occurs in the original list.

APPENDIX 2. INTERNET WEBSITES USED FOR MAILING LIST

http://www.logbuilders.net/

http://www.logassociation.org/about/index.php

http://www.loghomes.com/states/canada.htm

http://www.mhd5000.com/mhd-log.htm

http://www.log-world.com/log_directory.php

http://www.theloghomesite.com/temp/Log_Home_Builders/General_Contractors/

http://www.loghomeliving.com/ME2/default.asp

APPENDIX 4. MAIL SURVEY QUESTIONNAIRE

INVESTIGATING FIBRE SUPPLY ISSUES OF THE BC LOG HOME MANUFACTURING INDUSTRY

Before you start, please remember to answer all questions with respect to log home manufacturing within BC and for your business location only. Please answer the financial questions in Canadian dollars.

Production and financial information

1. For how long has your company been operating?.. _____ years

2. What is the main manufacturing method that best describes how your products are processed? *Check (✓) one box only.*

    ☐ machine milled   ☐ hand crafted

3. Please indicate the type of products your company produces using whole logs as the main building material. *Check (✓) all that apply.* If your company did not operate in 2002, *please go to Question 26.*

    ☐ Customized log homes packages not to lock up (any size)   ☐ Pre-designed log home packages (<2000 sq. ft total living space)
    ☐ Customized log homes packages to lock up (any size)   ☐ Pre-designed log home packages (>2000 sq. ft total living space)
    ☐ Multiple unit dwellings (townhouse, duplex)   ☐ Commercial buildings (lodges, businesses)
    ☐ Other, please specify_____

4. Using the categories above, list your three top selling products based on unit sales in 2002. *For each, please list the total number of units sold, average unit selling price, average unit size (total at manufacturing site), and average volume of logs used per unit.*
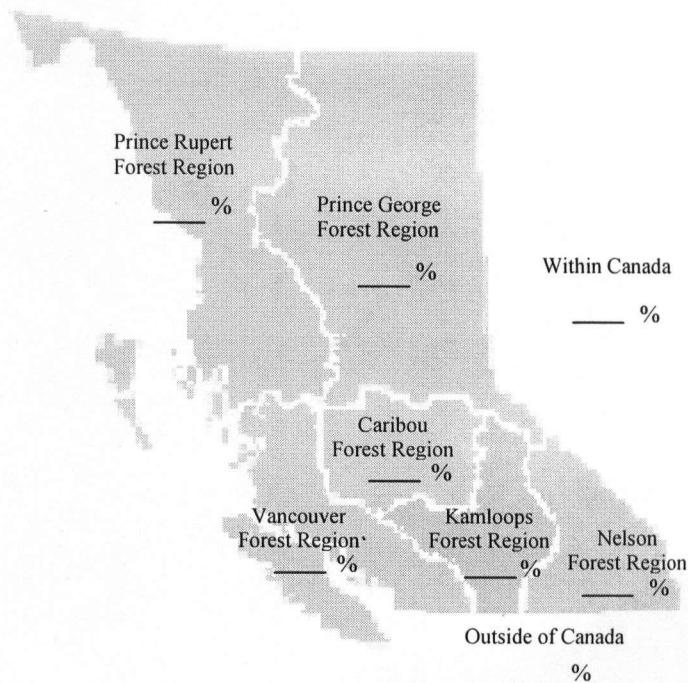
Product type	Total # of units sold	Average selling price per unit ($)	Average size per unit (sq. ft.)	Average volume of logs used per unit (m^3)
1.				
2.				
3.				

5. Please provide the total gross sales amount for your company for 2002. *Check (✓) one box only.*
    (Please note that financial data will be used in aggregate form only -- no individual company information will be released)

    ☐ $0 - $249,999   ☐ $250,000 - $499,999   ☐ $500,000 - $749,999   ☐ $750,000 - $999,999

    ☐ $1,000,000 - $1,999,999   ☐ $2,000,000 - $4,999,999   ☐ $5,000,000 - $9,999,999   ☐ $10,000,000+

6. Where were your major markets in 2002? *Please indicate the **approximate** percentages of gross sales in each area and circle the sales trend over the last three years --* ⇑ *increasing sales,* ⇓ *decreasing sales, and* ⇒ *unchanged sales.*

    British Columbia ____ % and ⇑ ⇓ ⇒   Rest of Canada ____ % and ⇑ ⇓ ⇒   United States ____ % and ⇑ ⇓ ⇒
    Asia ____ % and ⇑ ⇓ ⇒   Europe ____ % and ⇑ ⇓ ⇒   Other ____ % and ⇑ ⇓ ⇒

7. How many workers did you employ throughout 2002?........................._____ full time _____ part time _____ subcontractors

8. What was the average gross annual salary of your full time employees in 2002 (excluding benefits)?,...........$ _____ /yr.

Fibre supply characteristics

9. On the map to the right, please place a check mark (✓) in the forest region in which your business is located.

10. On the map to the right, please approximate the percentage (%) of your total log consumption coming from each forest region in 2002. If your company sources logs from outside the province, please provide the percentage from within Canada and outside of Canada. *Total should equal 100%.* If you do not know which forest regions your logs came from, *please skip to Question 11.*

11. How many different log suppliers did you use in 2002?........................ _____ suppliers

12. Please approximate the percentage of your total log consumption from each of the sources below in 2002. *Total should equal 100%.*

    Small Business Forest Enterprise Program ____ %
    Brokers/Wholesalers ____ %
    Logging company sortyard ____ %
    Specialty/Auction sortyard ____ %
    Other, please specify _____ ____ %
                            100 %

Prince Rupert Forest Region ____ %

Prince George Forest Region ____ %

Within Canada ____ %

Caribou Forest Region ____ %

Vancouver Forest Region ____ %

Kamloops Forest Region ____ %

Nelson Forest Region ____ %

Outside of Canada ____ %

13. Please fill out the following table of the log species consumed in 2002 and the average delivered to the manufacturing site price of each species. If one of the species below was not used in your products, leave the spaces blank.

Species	Total volume consumed (m³)	Average delivered price of logs per m³ ($/m³)
Pine		
Spruce		
Douglas Fir/Larch		
Cedar/Cypress		
Hemlock/True Firs		

14. Considering the logs that would fit into a majority of your company's design plans, what are *your* three (3) preferred log species and sizes? *Please provide species (from list above), top and bottom diameters and log length.*

Log species	Top Diameter (in.)	Bottom Diameter (in.)	Length (feet)
1.			
2.			
3.			

Current methods of assessing log purchases

15. Which of the following inspection methods do you use most when purchasing logs from your suppliers? *Check (✓) one box only.*

☐ Visual inspection of a sample of logs to be purchased   ☐ Detailed visual inspection of all logs to be purchased
☐ Peel one or both ends of several logs to be purchased   ☐ No inspection completed
☐ 3rd party inspection   ☐ Other, please describe _____

16. On average, what proportion of your purchased fibre supply *does not meet your* quality standards?................................._____%

17. If the raw material that you purchased does not conform to your quality standards, what happens?
Please rank the three (3) most common solutions with 1 being the most common and 3 being third most common.

____ Does not apply   ____ Buck out defect and utilize elsewhere in building
____ Return it to supplier   ____ Use where defect is not critical
____ Resell it to another business   ____ Other, please describe _____
____ Turn it into firewood   _____

18. Please rate how important the following log characteristics are to you when determining whether a log is suitable for your main product. *For each characteristic, please circle one number indicating the level of importance: 1=Not at all important to 5= Extremely important.*

Log characteristic	Not at all important				Extremely important
➢ Log straightness	1	2	3	4	5
➢ Log almost perfectly cylindrical	1	2	3	4	5
➢ Log dimensions on target	1	2	3	4	5
➢ Proper log species	1	2	3	4	5
➢ No knots greater than 5 cm (2 inches)	1	2	3	4	5
➢ Even distribution of small knots	1	2	3	4	5
➢ Presence of loose knots	1	2	3	4	5
➢ Lack of spiral grain	1	2	3	4	5
➢ Logs freshly cut	1	2	3	4	5
➢ Logs aged greater than 6 months	1	2	3	4	5
➢ Free from any splits	1	2	3	4	5
➢ Greater than 6 growth ring per inch	1	2	3	4	5
➢ Free from stump pull	1	2	3	4	5
➢ Free from all types of rot	1	2	3	4	5
➢ Free from mechanical damage	1	2	3	4	5
➢ Free from any staining of the wood	1	2	3	4	5
➢ Light coloured wood	1	2	3	4	5

19. Are there any log characteristics we failed to mention above that are important in determining log quality? If yes, please specify.

_____
_____

20. On average, how many hours per week were dedicated to the acquisition of fibre for your company in 2002?................._____hrs/wk.

21. Please rate each of the following issues in terms of their importance in your decision to purchase logs from a potential seller.
   For each issue listed, please circle one number indicating the level of importance: 1=Not at all important to 5=Extremely important.

	Not at all important			Extremely important	
➢ Readily available supply	1	2	3	4	5
➢ Log supply consistency	1	2	3	4	5
➢ Log supply quality	1	2	3	4	5
➢ Close to manufacturing site	1	2	3	4	5
➢ Competitive pricing	1	2	3	4	5
➢ Speed of delivery	1	2	3	4	5
➢ Exchange policy	1	2	3	4	5
➢ Ease of accommodating pick up or delivery	1	2	3	4	5

Alternate sources of fibre supply

For questions 22 and 23, please consider old growth timber as trees with narrow growth rings and second growth timber as trees with wide growth rings, ignoring the possibility of the trees being virgin timber.

22. Please state your level of agreement with the following statements as they pertain to your company's business philosophies.
   For each statement please circle one number indicating your level of agreement: 1=Strongly agree to 5=Strongly disagree.

	Strongly agree			Strongly disagree	
➢ Old growth timber is better than second growth timber for log home manufacturing	1	2	3	4	5
➢ Insect killed timber is a potential source of raw material for log home manufacturing	1	2	3	4	5
➢ Fire killed timber is a potential source of raw material for log home manufacturing	1	2	3	4	5
➢ Second growth timber is a potential source of raw material for log home manufacturing	1	2	3	4	5

23. Compared to the average delivered price you paid for *old growth timber* in 2002, how much of a discount would you need before considering purchasing the following material to incorporate into your building plans if it was a suitable size and quality?
   - Insect killed timber - _____ %
   - Fire killed timber - _____ %
   - Second growth timber - _____ %

24. If in 2002 you **did use** any of the fibre mentioned in the answer portion of Question 23, *please fill out the following table; otherwise skip ahead to Question 25.* If one of the product types was not used, please leave the spaces blank.

Product Type	Quantity purchased in 2002 (m³)	Average delivered price per m³ ($)	Year product was first used	Trend in purchasing (increasing or decreasing)
Insect killed timber				
Fire killed timber				
Second growth timber				

If you completed any part of the above table, please continue on to Question 26.

25. If you **did not use** any of the materials listed in Question 23, please state the reasons why not. *Check (✓) all that apply.*

☐ Material not available ☐ Safety considerations ☐ Perceived quality problems ☐ Aesthetics
☐ Lack of consumer demand ☐ Difficult to handle ☐ Workability ☐ Perceived durability
☐ Other issues (please specify)_____

Resolving fibre supply issues

26. Please indicate your level of agreement with the following statements as they pertain to your company's fibre supply issues.
   For each statement, please circle one number indicating your level of agreement: 1=Strongly agree to 5=Strongly disagree.

	Strongly agree			Strongly disagree	
➢ Having one supplier provide me with all my raw material needs would benefit my company	1	2	3	4	5
➢ I am happy with the service I receive when purchasing logs directly from my suppliers	1	2	3	4	5
➢ My suppliers are trying to provide a product suited to my business	1	2	3	4	5
➢ Paying a premium for fibre that meets all my company's log quality specifications is worthwhile	1	2	3	4	5
➢ The provincial government has a good understanding of the BC log home manufacturing industry	1	2	3	4	5
➢ I would purchase logs from a government run log sortyard	1	2	3	4	5
➢ Large forestry companies have a good understanding of the BC log home manufacturing industry	1	2	3	4	5
➢ Large forest companies would readily supply logs to my company	1	2	3	4	5
➢ The dimensions of logs we require is easily available	1	2	3	4	5
➢ The quality of logs we require are easily available	1	2	3	4	5
➢ The logs we require are available at a fair price	1	2	3	4	5
➢ A steady supply of high quality fibre is difficult to find	1	2	3	4	5

3

27. Please indicate your level of agreement with the following statements as they pertain to resolving fibre supply issues for your company. *For each statement, please circle one number indicating your level of agreement: 1=Strongly agree to 5=Strongly disagree.*

I support....

	Strongly agree				Strongly disagree
➢ ..forest company specific quotas to sell house logs to log home manufacturers	1	2	3	4	5
➢ ..forest region specific quotas to sell house logs to log home manufacturers	1	2	3	4	5
➢ ..governmental funding of specialty log sortyards in several locations throughout the province	1	2	3	4	5
➢ ..export restrictions on fibre meeting log home manufacturers size and quality requirements	1	2	3	4	5
➢ ..removing restrictions on logs imported into the province for the purpose of value added manufacturing	1	2	3	4	5
➢ ..forming buying cooperatives to improve buying power	1	2	3	4	5
➢ ..forming business relationships with First Nations in order to secure a dedicated fibre supply	1	2	3	4	5
➢ ..forming business relationships with integrated forest companies in order to secure a dedicated fibre supply	1	2	3	4	5
➢ ..using fibre facilitators through log home building associations to secure fibre for my company	1	2	3	4	5
➢ ..changing the current provincial log grading system to include a category specifically for house logs	1	2	3	4	5
➢ ..a new category of small business timber sale exclusive to the log home manufacturing industry	1	2	3	4	5
➢ ..redistributing the weighting system in current small business sales to favour log home manufacturers more	1	2	3	4	5
➢ ..woodlot like tenures exclusive to value added manufacturing companies to provide a dedicated fibre supply	1	2	3	4	5

General questions

28. If your company turned down orders in 2002, please rank the top three reasons *(1 being most often cited and 3 the third most cited reasons)*. If you did not turn down work, please go to Question 29.

____ Did not want the extra work ____ Technical considerations (engineering/architectural)
____ Improper tree sizes for order ____ International trade law (quarantine, permits, other red tape)
____ Lack of proper tree species for order ____ Quality of fibre supply
____ Lack of consistent fibre supply ____ Other (please specify)_____
____ Not enough trained personnel _____

29. Please list what you consider to be advantages and disadvantages of operating in the BC log home manufacturing industry
Advantages:_____ Disadvantages:_____

30. Are you currently providing other **value added wood** products in your product packages? *Check (✓) all that apply.*

☐ Cedar roofing or siding ☐ Wood framed windows and doors
☐ Board and batten siding ☐ Patios and decks
☐ Wood cabinetry ☐ Interior design additions (ceiling/wall finishing, etc)
☐ Solid wood flooring ☐ Engineered wood panel flooring
☐ Other items, please specify_____

31. Do you have any additional comments you would like to make about the log home building industry in BC? Please use the space below.

Thank you for your time and co-operation in completing this survey. Your participation is greatly appreciated.

Please return your completed questionnaire in the enclosed self addressed and stamped envelope to:

BC Log Home Manufacturers Survey PO Box 95063 Kingsgate RPO Vancouver BC V5T 4T8
Phone (604) 822-0161 Fax (604) 822-9106

APPENDIX 6. REFINED SAMPLE FRAME LIST

659541BC
A Fine Logbuilding Co.
A. Chevigny Log Construction
Acadia Log Homes Ltd.
Arbor Vitae Log Craft
Arrowsmith Log Building
Artisan Custom Log Construction
Ayrewood Log Homes
Bavarian Leisure Cottages
Beaver Contracting
Beaveridge Contracting
Belview Homes
Benbow Construction
B-i-g Developments Limited
Big Foot Mfg Inc.
Big Log & Timber House Company Ltd.
Big Rock Homes Limited
Bigfoot Hand Hewn Log Homes Inc.
Bowron Valley Log Homes
Brian Moore Log Homes Limited
Bruin Log Works
Calija Log & Timber Homes Limited
Canada Logworks Limited
Canada's Log People Inc.
Canadian Fine Products Inc.
Canadian North Log Homes Inc.
Canadian Pride Log Homes
Canadian Timber Products
Canadian Walden Log Homes
Canalog Wood Industries Limited
Cancedar Log Homes Ltd.
Cascade Handcrafted Log Homes Ltd.
Cascade Handcrafted Log Homes Ltd.
Casia Enterprises Ltd.
Cedar Mill Log Homes
Chilliwack Mountain Log Homes Ltd.
Club Enterprises (Canada) Inc.
Colin Solly Construction
Continental Log Homes
D & V Logworks
Daizen Log-Tech Limited
Damstrom Log and Timber Homes
Dene Log Crafters

Derynck Log Construction
Don B Gervais Log Homes
Dorish David Contracting
Double Eagle Timbercraft Limited
Ducharme Log Homes
Durfeld Log Construction
Durfeld Log Construction Ltd.
Eagle's Nest Log Industries
Eagleye Precision Log Homes
Eco-Log-Homes
Falcon Log Homes
Fink Custom Log Homes Ltd.
Finlayson Log Homes
Fire Valley Log Homes
Forbes Landing Log Homes
Gateway Timber Frame Construction
Golden Nugget Log Homes
Gord Hill Log Homes
Grizzly Peak Log Homes
Hamill Creek Timberframe Homes
Harris Log Homes
Heatherbrae Construction
Herridge Custom Profiling Limited
High Country Log Homes
High Mountain Log Homes
Hodson Logbuilding
Hudson's Hope Log Homes Limited
Ideal Log Homes
J J Log Homes
Japan-Canadian Log Ark Ltd.
Jim Pownall & Co.
Kanstam Log Homes Limited
Karsten Construction
Keeko Log Homes
Key-Oh Wood Products Ltd.
Khita Log Builders Limited
Kicking Horse Log Homes
Kodiak Log Homes
Kootenay Lake Log Structures Limited
Laidlaw Custom Log Homes
Lake Country Log Homes
Leatherwood Log Homes Limited
Legacy Log & Timber Homes

APPENDIX 6. REFINED SAMPLE FRAME LIST CONTIONUED

Little Log Company
Lloyd Ventures
Lobo Log Crafters
Log & Timber Homes
Lussier Log Homes Limited
Majestic Log Homes Ltd.
Mara Mountain Log Homes
Maurer Log & Timber Frame Homes
Mcmahan Log Homes
Mile High Log Homes International
Morgon Log Homes Ltd.
Mountain Valley Log Homes & Wood Products
Mountainview Log Structures
Natures Best Log Homes Limited
Neville Log Homes of Canada
Nicola Logworks
Nolte Log Homes
Nordik Log Homes
Norse Log Homes Ltd.
North American Log Crafters Limited
North River Log Homes
North Road Log Homes
Northern Light Classic Log Homes
Northern Log Homes
Northern Spirit Log Homes
Northern Timberworks
Odermatt Log Home Manufacturing
Okanagan Vertical Log Homes
Old Yale Log Homes Limited
Original Log Homes Limited
Owl Ridge Timber Framing
Pacific Log Homes Limited
Pacific Timber Frame
Patrick Custom Log Homes
Pattern Log Homes
Peco Log Homes
Pioneer Log Homes Limited
Princeton Forest Products Limited
Pro Log Homes
Qci Log Homes
Quality Log Homes Limited
Quinkatla Development Corporation
Radomske Log Homes Ltd.

Ram Creek Log Homes
Rasmussen Log Homes Limited
Red Willow Rustic Log Homes
Rockwood Homes
Rocky Point Log Homes
Rouck Bros Sawmill Limited
Roundwood Log Homes
Saik'uz Legacy Homes Limited
Sea-Change Log Homes
Shalalth Log Homes
Sitka Log Homes Inc.
Snowy Mountian Log Crafters
Sonora Log & Timber Structures
Sperlich Log Construction
Stealth Log Homes
Sun Peaks Log Homes
Sunset Log Homes Ltd
Superior Log Homes
Surefit Log Homes
Surelog Homes Ltd
Swiz Timber Frame Homes Inc
T.L. Timber/ Sierra Log Homes
Tall Timber Log Builders
Tanglewood Log & Timber Frame
The Big Log & Timber House Company Ltd.
The Log Connection-Log Home Specialists
Tiny's Contracting
Top Notch Log Construction
Touch O Country Log Homes Limited
Traditional Log Homes Limited
Treehouse Log Homes
True-craft Log Structures Limited
Unique Timber Corporation
Vancouver Island Log Homes
Vintage Construction
West Chilcotin Log Crafters
West Coast Log Homes Limited
Western International Log Homes Limited
Whistler Log Homes Limited
Whistler Valley Log Homes
White Valley Log Homes Limited
Woody Creek Homes Ltd

APPENDIX 7. NON RESPONSE BIAS RESULTS USING TWO TAILED T-TEST

t-Test: Two-Sample Assuming Unequal Variances

	Business age	
Mean	15.4375	19.2
Variance	66.31854839	111.733333
Observations	32	10
Hypothesized Mean Difference	0	
df	13	
t Stat	-1.033802574	
P(T<=t) one-tail	0.160038982	
t Critical one-tail	1.770931704	
P(T<=t) two-tail	0.320077963	
t Critical two-tail	2.16036824	

t-Test: Two-Sample Assuming Unequal Variances

	Full time employees	
Mean	9.962962963	8.285714286
Variance	156.4216524	86.57142857
Observations	27	7
Hypothesized Mean Difference	0	
df	12	
t Stat	0.393577869	
P(T<=t) one-tail	0.350398099	
t Critical one-tail	1.782286745	
P(T<=t) two-tail	0.700796198	
t Critical two-tail	2.178812792	

t-Test: Two-Sample Assuming Unequal Variances

	Total volume purchased	
Mean	1526.326	2572.5
Variance	2810365	15354738
Observations	26	6
Hypothesized Mean Difference	0	
df	5	
t Stat	-0.64058	
P(T<=t) one-tail	0.274997	
t Critical one-tail	2.015049	
P(T<=t) two-tail	0.549994	
t Critical two-tail	2.570578	

APPENDIX 8. PRODUCT CATEGORY LIST AND DEFINITIONS

A typical log home package consists of:

- log walls and posts
- log floor joists
- roof system (rafters, purlins, trusses, etc.)
- log stairs and railings (if applicable)
- through-bolts, pins, screw jacks (Houdek, 2001)

All product categories are built primarily of logs or large timbers that form the exoskeleton of the building:

Custom log home not to lock up
- building designed to customer specifications
- manufacturing is limited to producing the building shell and roofing system
- customer is responsible for building erection and all other construction and finishing phases

Custom log home to lock up
- building designed to customer specifications
- manufacturing includes the production of the building shell and roofing system, supplying all doors and windows, plus any additional design features
- manufacturer is responsible for building erection
- manufacturer or owner responsible for all other construction and finishing phases depending on contract negotiation

Pre-designed log home
- customer chooses building plan from a selection provided by manufacturer

Multiple units dwelling
- buildings manufactured for the purpose to contain multiple self-contained dwellings

Commercial building
- buildings manufactured for the purpose to conduct commercial activities, for example, restaurants, lodges, bed and breakfast, or information centres.

Other
- respondent specified building type

APPENDIX 9. LIST OF RESPONSES TO QUESTION 29 OF THE MAIL SURVEY

Advantages
Probably the best building logs in the world
Slow growth timber
Wood
Supply of Western Red Cedar logs required for the European market
Best wood in the world
Good fibre
Very good supply
Log source
Fibre availability
Fibre
Access to raw materials
Wood is available
Quality of fibre
We do have a good supply of quality lumber
Good location to export to Japan
Quality of fibre
World recognizes BC quality fibre
Close to international ports
Own boss
Fibre quality
Access to logs in BC
Location in the best forest in the world
Availability of wood supply
Proximity to excellent quality house logs (on Vancouver Island)
None, we can use junk timber and cull poles but hand crafters have to use expensive straight logs. We lathe our logs straight.
Availability of high quality wood
Forest resources
We have the growth potential to expand our USA markets if we could better access timber.
Good logs if available
Good reputation province wide
Good supply of timber
Interesting work
Great timber (as long as it remains affordable and accessible)
Access to good fibre
International reputation of a superior product
Supply of the best wood
Variety of species
Awesome potential for log supply

<u>Advantages</u>
Trained personnel
Good reputation
Quality and variety of logs compared to rest of North America
Variety of log species
Close to markets or shipping aboard (sic) excess
Can -> USA exchange
Currency exchange
We do have a good supply of quality lumber
Log home manufacturing centre
History of craftsmanship
Should have good wood supply
Future world growth/demand
Excellent marketing to US customers
Image of Canadian wilderness
People resources
Small town atmosphere
Access to shipping ports
Challenging locations
US competition
International reputation for the finest timber
Best trained builders backed by professional association.
Low shipping costs of raw material
Close to Western States
Access to markets globally
Location in relation to U.S. & port of Vancouver
Reputation worldwide
Apprentice program
Environment conclusive to developing sophisticated levels of craft
Recreation for employees
Travel to different cultures
Skilled labour

Disadvantages
Trucking costs to haul bug killed logs down from up North
Limited demand in BC and Canada
Long distance shipping costs to Europe
Inconsistent fibre supply
Pre-fabbed log homes to Europe must be kiln dried , except Cedar ,kiln drying logs is
expensive
As we use dry wood we should pay just over pulp price, however because of illegal log
exports we pay the same as majors for #1 sawlogs
Fibre being made available
Taxes
Quality of raw materials
Wood is hard to get
Softwood tariff
Too many log manufacture
Expense of fibre
Lack of local market
Despite the amount of logs in BC still hard to get good wood
Acquisition of logs/suitability
Taxes
Not enough skilled workers
Lack of gov't help programs
Property taxes (industrial)
Lack of understanding in resource management
Time for accessing proper timber for a fair price
Competition
Large forest company monopolies
Timber supply in general
Access to good fibre
Shortage of skilled workers
High shipping costs
Vulnerable to price swings
Poor access to fibre
Prices soaring as soon as you saw house logs
We pay too much for house logs
Proximity to markets
Red tape
Establishing clients
First Nations competition - i.e. they pay no taxes so they can sell cheaper

Disadvantages

Forestry pays no attention to our needs
Qualified log builders
Competitor subsidies - i.e. to ethnic minorities and special interest groups
Transportation costs
Social/economics
Competing for BC timber against US companies with US $
Special zoning which is not a blanket industrial
Vancouver Island -ferries
Lack of a sustainable approach to our resources
Difficulty accessing proper timber for a fair price.
BC government changing timber sale criteria to none employment
Foreign competition on our soil
Cost of fibre
Excessive time committed to ensuring a steady fibre supply
Difficult export restrictions
Lack of understanding by Govt as to how big our industry is
Price variation

APPENDIX 10. COMMENTS RECEIVED IN QUESTION 31 OF THE MAIL SURVEY

<u>Comment</u>

I would like to see more areas in BC designated for select logging of mature trees instead of typical clear cutting of all tress in mature treed areas. Thus saving government costs of replanting & thinning & spraying, etc.

We rarely experience difficulty acquiring good quality logs. My observation is that log home companies with good purchasing policies / that work to develop rapport with log suppliers / that pay on time...don't have a problem with fibre supply. The log home companies that play an adversarial game with suppliers can be weeded out. This is the same in any business. I know of companies that have a difficult time buying wood...but not because of availability.

We like what we been doing, the future looks bright. There is a hugh (sic) market out there.

I have been trying for 2 weeks to source 5 loads (200 m^3) of bug killed pine house logs (11"+ tops) – nothing. Most of it goes across the border is my understanding. I could sell more of it – but I can't get it.

The spirit of the craft has increased my knowledge as an individual and as a log building team, we are able to display this vast knowledge in our craft. For us, 'log building' has turned into an incredible vehicle to show some of the true values that we have been blessed with in BC! I believe and recomend (sic) to others that our approach to resource utilization become 'cultural based'.

I did not have any orders for log houses in 2002. I did send two to Switzerland in 2001 & will be doing so in 2003 most likely.

Order a copy of "Log building constructional manual" by Robert Chambers. www.logbuilding.org and "log home building standards" from the Int. Log Building Ass. Lumby, BC. *Coast old growth is too big and tends to "pitch ring", & rot. I support small privatised (sic) sortyards <u>not</u> for goverment (sic) revenue, but profit to the small guy. Why should the gov. run the sortyards, they'll just line their pockets & keep it. Focus on building <u>small business.</u>

The LBI association has accomplished a number of things that have helped our operation:
- apprentice program
- health and safety program
- maintaining industry profile with govt.

We are located here because of excellent input fibre/logs – BC is known for its excellent log homes (hand crafted & milled) due to this and our advances in worker skills, provide us with the best logs so we can stay on top! Find another use for the bugey (sic, referring to bug killed timber) and rock hard waste logs. i.e. export them & keep our best for value added use!
There is a great opportunity for growth. It may seem like a waste of wood to use so much in logs or timber frame homes but the primary lumber industry provides little employment and low value to high quality fibre.

As our homes sold in 2002 have ranged in size from 300 sq. ft. to 112,000 sq. ft. it is impossible to provide an accurate unit price.

Some log building outfits in BC have received large amounts of money to build their business particularly if they work with natives. I think this whole native thing is getting out of hand. MOF is cattering (sic) to big business and not eneough (sic) to small value added company's.

1) Never enough quality fibre
2) Competing against First Nations who pay no taxes is completely unfair as we have paid their share of taxes to keep them going only for them become subsidized competitors.
3) Not enough interest by government for training. Serious undersupply of personnel.
4) Emergence of Log Building Industry Association of BC has helped significantly.

Dear Sir/Madam

I would like to thank you for asking these questions as I think that this industry could be a lot bigger in BC because the international market place is virtually endless.

I really like the idea of woodlots or some tract of land that we could manage with the assistance of RPF's in our province.

The very trend of tree farm licences becoming larger, should be an obvious indication that (true) small business is no longer a noticeable portion of the industry. If, in BC we still have any voice whatsoever it should be to vito (sic) the advancement & inevitable takeover by the Americanization & sellout. Our birthright & heritage is crumbling. Our forefathers are rolling in their graves!

Big Foot Log Homes – owned and operated by R.C Core Japan and Unique Timber Corp – owned and operated by Baumstemm Germany. There are another ½ dozen company's on the coast owned by Asian head offices and all have timber sales under the small business program. The government will soon issue the new sales to the highest bidder as their new policy and this will seal the fate of many Canadian owned and operated small business.

APPENDIX 10. COMMENTS RECEIVED IN QUESTION 31 OF THE MAIL SURVEY CONTINUED

In general,
- Stop all exports of raw logs
- Promote & support manufacturing in BC.

Please contact the Log Building Industry Association of BC for data gathered with respect to many issues asked in this questionnaire. It would be benneficial (sic) if our industry was allowed to voice our opinions at government held discussions concerning fibre access.

If we had a good source of fibre we feel confident we could have a labour force of 100 people or more. We "turn down" orders every week!

For us to ask for beetle killed timber say in the Quesnel forest district one would be told "no, we have no fibre for you." Do we not have a beetle problem and what a waste of fibre and jobs.

To whom it may concern;

We do not use raw logs, we use sawn cants in our homes, so many of the questions do not relate. As a note, it is a constant struggle to get raw wood fibre as a supply (good wood) since many of the majors (sawmills) dominate the market. It does not seem to be a concern that high value added manufacturers as ourselves are recognized as we should be.

Keep the idiots that run the forestry out of our planning. In 1991, they awarded us a V added sale that was supposed to be 16,000 meters and told us we had to use 50% and could sell the rest. They also told us it was worth $85 per meter on the Market. Well, it sold for $47 per meter and our cost to log were $42 plus stumpage of $15. They then told us we had to log 2000 meters of each. Cedar, hemlock & cypress before reducing the price, needless to saw (say?) we nearly went broke. Also we logged 47,000 meters off there, 16,000 meters (illegible) they then informed us we were not in compliance because we didn't use 23.5 thousand meters in 2 years. As far as I am concerned, forestry is nuts. It took me 10 years to get back out of the hole.

APPENDIX 10. COMMENTS RECEIVED IN QUESTION 31 OF THE MAIL SURVEY
CONTINUED

Dear Sirs.

I filled part of your questionnaire out with reluctance because any time I have been involved with a person that does nothing but plan for an industry that he does not own or operate it turns to be a job making enterprise for the planer and does not help us guy that use our money and labour to start and operate a business.

I started make log homes by hand in the 1960's. So what happened Alan Mackay (a woodwork instructor in School) gets a grant to teach people to make log houses he couldn't and probably still can't make one at a reasonable cost and it goes on and on. I made a lathe to use junk logs and make a reasonably priced house now there is so many god damned many building inspectors that don't know anything about insulation re. log house that they are killing the log home business.