CHAIN OF CUSTODY CERTIFICATION: CURRENT STATUS AND LEVEL OF KNOWLEDGE IN THE NORTH AMERICAN SOLID WOOD SECTOR.

by

NATALIA GIUGNI VIDAL

Bachelor of Science in Forestry, Sao Paulo State University, Brazil, 1998

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Department of WOOD SCIENCE

The University of British Columbia
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ABSTRACT

Chain of custody certification has influenced the marketplace for forest products over the past two decades. A category of forest certification, chain of custody certification is responsible for providing a guarantee that the wood product purchased was manufactured with raw materials from environmentally certified sources.

Information on how North American primary wood product companies are addressing chain of custody certification is scarce. However, it is critical for the further development of this concept. A survey of primary wood products manufacturers was conducted in order to verify the current status of chain of custody certification in Canada and the United States. Accredited certification bodies in North America were also interviewed by telephone. Results indicate that approximately 50% of primary wood producers will be certified by 2007 and that the acquisition of benefits from chain of custody certification may be a key factor in increasing adoption levels.

A cluster analysis and a determinant function analysis suggest that company size is an important variable to be considered when analyzing the adoption of chain of custody certification by primary wood producers. According to these analyses, larger companies are more likely to be chain of custody certified than smaller companies. In addition, larger companies seem to be more cognizant of the benefits to be accrued from chain of custody certification. The costs of implementing chain of custody certification are also related to company size with a general trend being lower costs for larger companies.

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1. INTRODUCTION

Companies must continually adapt to new conditions in the marketplace. A case in point is forest certification, which has been recently introduced into the marketplace for forest products over the past two decades. A result of public concern about environmental degradation, forest certification aims to provide a guarantee to customers that a forest product comes from a sustainably managed forest (Upton and Bass 1995). There are two types of forest certification: (1) forest management certification, which certifies forestry practices only; and (2) chain of custody certification, which certifies every stage of the supply chain involved in the production of certified wood products. The type of forest certification that should be used depends on the company's position in the supply chain; chain of custody certification could be considered a continuation of forest management certification.

Chain of custody certification is a guarantee that the wood product purchased really comes from an environmentally certified source (Groves et al. 1996). It requires the implementation of tracking systems that trace the certified raw material from the time it leaves the forest until the final product reaches the end consumer (Groves et al. 1996). Chain of custody certification is still considered to be a new concept. Nevertheless, it is already exerting considerable pressure on forest products companies (Vogt et al. 2000).

The main objective of this research is to determine the actual status of chain of custody certification in primary wood industries in Canada and the United States. The following specific objectives will be achieved:

1. To assess the current and expected adoption levels of chain of custody certification;
2. To assess the level of knowledge and perceived benefits/costs that non-certified companies have about chain of custody certification;
3. To examine the requirements of implementing chain of custody certification, including costs, methods and technologies used, and the resulting benefits.

Forest certification is one of the results of a series of events dating back to 1960's that aimed to address the degradation of natural resources (Fanzeres and Vogt 2000). It was

developed as an alternative to several other actions from governmental and non-governmental institutions that did not have the expected results (Elliott and Donovan 1996). In order to understand the objectives of forest certification, it is necessary to understand the context in which forest certification was developed. Chapter 2 provides information on the historical background of forest certification as well as the main characteristics of this mechanism.

In short, the main aim of forest certification is to improve forest management by providing participating companies with marketing incentives (Upton and Bass 1995). In other words, companies are encouraged to participate by the promise of acquiring benefits like access to niche markets. The mechanism of forest certification as a market access tool is explained in Chapter 2. Specific information on chain of custody certification is generally scarce. There are few studies regarding this topic, especially related to the primary wood industry in North America. However, it is important to understand how chain of custody certification works in order to provide companies with better means of addressing this issue. Information concerning the characteristics and consequences of implementing chain of custody certification for a company is also presented in Chapter 2.

A survey of primary wood products companies in Canada and the United States was conducted in 2002. It had the objectives of identifying the current characteristics of chain of custody certification for these companies as well as their perceptions about many of the aspects of chain of custody certification. The study also included a survey of North American certification bodies. The specific research and analysis methodology used and the results of these surveys are presented in Chapters 3 and 4, respectively.

The current status of chain of custody certification for primary wood products companies in North America is dependent on many variables. The identification of variables that are important in determining the certification status of companies is essential for future developments of the chain of custody certification concept. Chapter 5 consists of a discussion of these main points.

Lastly, concluding remarks on the status of chain of custody certification for primary wood products companies in Canada and the United States are provided in Chapter 6.

2. BACKGROUND

2.1. DEVELOPMENT OF FOREST CERTIFICATION

Forest certification is a recent topic that is having an increasing impact in forest product markets as well as generating great interest among forest landowners and forest products manufacturers (Vogt et al. 2000). It is the consequence of a series of events dating back to the late 1960s when society started to become concerned about the preservation of the natural environment (Fanzeres and Vogt 2000). Figure 2-1 summarizes some of the most important events in the history of forest certification. All of these events led to the concept of sustainable forest management, meaning that forests should be managed with equal importance given to environmental, social, and economical aspects (Fanzeres and Vogt 2000). However, it was only in late 1980s that forest certification started to become a reality. At that time, there was great public concern with regards to the deforestation rates of tropical forests. As a result of this increasing concern, boycotts of tropical forest products were organized by some environmental organizations (Fanzeres and Vogt 2000). This apprehension was gradually extended to all types of forests (Elliott and Donovan 1996). The 1992 United Nations Conference on Environment and Development (UNCED) was a critical event in the launch of forest certification. It was after UNCED that "the first set of principles, criteria, and indicators was released on how sustainable forest management should be conducted and evaluated for forest certification" (Fanzeres and Vogt 2000).

While forest certification had its origin in the increasing public concern about environmental degradation, it was created as an alternative to "inefficient international initiatives, government policies, and boycotts in reducing deforestation and promoting sustainable forest management" (Elliott and Donovan 1996). Forest certification was developed as a guarantee to customers that a forest product comes from a source managed in accordance with the principles of sustainable development and does "not favor unsustainable or inequitable practices" (Upton and Bass 1996).

Figure 2-1: Forest certification chronology (Fanzeres and Vogt 2000, Upton and Bass 1996, Lyke and Fletcher 1992).

Date	Event	Description
1968	The Biosphere Conference	The introduction of the concept that environmental degradation is a consequence of "rapid population growth, urbanization, and industrialization" (McCormick 1989 cited in Fanzeres and Vogt 2000).
1970	First Earth Day	Commemorated in the United States in April 1970. This event demonstrated that an increasing number of people were discontent with environmental devastation.
1972	United Nations Conference on the Human Environment	The paradigm of sustainable development was officially introduced as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It was later published as the *Brundtland Report*.
1972	Creation of the United Nations Environmental Agency	"This agency aimed to bring the design of environmental-related policies to an international framework, and to provide assistance for developing countries through information sharing and technology transfer" (Fanzeres and Vogt 2000).
1983	World Forest Appraisal Program	The 1983 report of this program of the United Nations Food and Agriculture Organization (FAO) generated alarm about the state of the world's forests and a worldwide debate on forest issues and sustainable development (Fanzeres and Vogt 2000).
1983	International Tropical Timber Agreement	This agreement established the International Tropical Timber Organization (ITTO).
1985	The Tropical Forest Action Plan	This was a joint initiative of FAO, UNDP*[1], the World Bank, and the World Resource Institute. It was developed with the aim of slowing tropical deforestation and helping countries achieve sustainable forest management (Fletcher 1992).
1987	The Brundtland Report	"Also known as *Our Common Future*, this report alerted the world to the urgency of making progress toward economic development that could be sustained without depleting natural resources or harming the environment." (ARIC 2001).
1988	The Muntingh Proposal	The European Community stated that they would only import certified tropical wood products produced under sustainable forest management and protection programs (Crosley 1996 cited in Fanzeres and Vogt 2000).
1990	ITTO Guidelines for the Sustainable Management of Tropical Forests	An ITTO initiative on providing a reference for member countries in their course towards sustainable forest management.
1992	United Nations Conference on Environment and Development	Produced the *Rio Earth Summit*. It was the first worldwide attempt to reach consensus on forest issues. Officially, forest certification is considered one of the consequences of this conference.
1992	Austria prohibited importation of tropical forest products	The Austrian government passed legislation in response to the increasing pressure of local NGOs*[2]. This measure was suspended in 1996 by the World Trade Organization.

Date	Event	Description
1992	Dutch Working Group of Experts	The Dutch government created this group as an effort to determine what the standards for sustainable forest management would be. Strong denunciations to the General Agreement for Tariffs and Trade and the European Union stopped the process.
1992-93	Indonesia Lembaga Ekolabel	Pressure from importing countries led Indonesia to create the Indonesian Ecolabeling Institute and to develop standards by which sustainable forest management should be conducted.
1993	Initiative Tropenwald	This German initiative developed criteria for an evaluation of the sustainable management of tropical forests.
1993	Creation of FSC	The Forest Stewardship Council (FSC) is a non-profit, non-governmental organization headquartered in Mexico that was created to support sustainable forest management.
1993	ISO created Technical Committee (TC) 207	The International Standards Organization (ISO) created the TC 207 to develop standards and guidelines for sustainable forest management.
1994	Year 2000 Objective	The International Tropical Timber Organization (ITTO) member countries*[3] voluntarily committed themselves to ensure that all trade of tropical timber would be completely from sustainable managed forests by the year 2000.
1994	Establishment of SFI program	The American Pulp and Paper Association (AF&PA) established the Sustainable Forestry Initiative (SFI) as a response to increasing public pressure on forest practices issues.
1995	Creation of the first buyers' group	The Global Trade and Network program was an initiative of the Worldwide Fund for Nature (WWF) as a means of creating demand for certified forest products.
1999	Creation of the PEFC	The Pan European Forest Certification (PEFC) Council is a European initiative created to support sustainable forest management.

*[1]UNDP = United Nations Development Program; *[2]NGOs = Non-Governmental Organizations;
*[3]ITTO member countries = Cameroon, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Gabon, Ghana, Liberia, Togo, Cambodia, Fiji, India, Indonesia, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, Vanuatu, Bolivia, Brazil, Colombia, Ecuador, Guatemala, Guyana, Honduras, Panama, Peru, Suriname, Trinidad and Tobago, Venezuela, Australia, Canada, China, Egypt, European Union (Austria, Belgium/Luxembourg, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom), Japan, Nepal, New Zealand, Norway, Republic of Korea, Switzerland, United States of America.

2.2. FOREST CERTIFICATION SCHEMES

Forest certification can be accomplished in three different ways: first, second, or third-party certification. These three categories describe the nature of the relationship between the auditor and the party being audited. First-party certification is "an internal assessment by an organization of its own systems and practices." Second-party certification constitutes an

assessment of a company's practices by a customer or outside trade organization. The assessment of forestry activities, based on a set of accepted principles and standards, defines third-party certification (Ervin et al. 1996, Hansen 1997, Bruce 1998 cited by Furnas et al. 2000). This type of certification is undertaken by accredited certification organizations that have no self-interest in specific forest activities (Upton and Bass 1996).

Forest certification can also be classified by the certification system approach. Performance-based and management system-based are the two most commonly used categories. A performance-based certification means that the audited party is meeting a set of accepted standards. A management system-based certification guarantees that "the audited party has developed and adopted a management system which is conducive to environmental monitoring and improvements in environmental performance over time" (Furnas et al. 2000).

Based on these classifications, some organizations have developed their own standards on how to manage forests along with sustainability principles. They include the Forest Stewardship Council (FSC), the Sustainable Forestry Initiative (SFI) of the American Forest & Paper Association (AF&PA), the International Organization for Standardization (ISO), the Canadian Standards Association (CSA), and the Pan European Forest Certification Council (PEFC) (Furnas et al. 2000, Hansen et al. 2000). These organizations usually accredit third-party certification bodies that work in accordance with their pre-specified standards (Upton and Bass 1996).

Activities around the creation of the FSC began in 1990, but it was only officially founded in 1993. FSC is an independent, international, non-profit, and non-governmental organization based in Oxaca, Mexico (Furnas et al. 2000). There are 11 certification organizations accredited by FSC worldwide; the Silva Forest Foundation in Canada[1], the Rainforest Alliance SmartWood Program and Scientific Certification Systems in the United States are the certification bodies accredited by FSC in North America (FSC 2001). FSC endorses ten principles and their respective criteria for forest management. It is not a

[1] It should be noted that the Silva Forest Foundation ended their forest certification operations in 2003, while KPMG FCSI (Forest Certification Services Inc.- Canada) received FSC accreditation in 2003.

management system-based approach, although it does include management planning and monitoring (Rotherham et al. 2000). Certified companies are allowed to label their products using the FSC logo (Furnas et al. 2000).

The SFI program of the AF&PA was adopted in October 1994. The AF&PA is a non-profit organization based in Washington, D.C., representing approximately 84 percent of paper production, 50 percent of solid wood production, and 90 percent of the industrial timber companies in the United States (Furnas et al. 2000, Rotherham et al. 2000, Jenkins and Smith 1999). They operate only in Canada and the United States. It is a management system-based program with five sustainable forestry principles guiding 11 objectives that are supported by specific performance measures (Rotherham et al. 2000, Meridian Institute 2001). Companies complying with the SFI program can choose to conduct a self evaluation, to be evaluated by a customer or another company, or to contract a third-party independent auditor (Rotherham et al. 2000). Third-party verifiers must be accredited by the Registrar Accreditation Board (RAB) or by its joint National Accreditation Program with the American National Standards Institutes (ANSI). There are four categories of environmental auditor in RAN and ANSI, anyone being valid for SFI's purposes. The program has developed two types of logos: one for companies that have not completed third party verification and another for companies that have completed it (Meridian Institute 2001).

ISO is an international non-governmental organization based in Geneva, Switzerland. It is composed of several member organizations from different countries. These ISO members are national standards bodies with the objectives of promoting international standards and facilitating trade (Rotherham et al. 2000). ISO 14000 is a series of international, voluntary management standards concerning environmental management (ISO 2000). The most important standard for forestry is the ISO 14001 Environmental Management Systems (EMS) standard approved in 1996 (Rotherham et al. 2000, ISO 2000). An independent third-party contractor accredited by the local ISO member performs the certification. There is no product labeling for ISO (Furnas et al. 2000, Rotherham et al. 2000).

The ISO approach has been largely accepted in Canada. The CSA has been developing the Sustainable Forest Management (SFM) system standards heavily based on ISO 14000 standards. The CSA is a non-profit organization located in Mississauga, Ontario. The SFM program operates only in Canada, with third-party auditors being accredited by the Standards Council of Canada (SCC). At the moment, there are two accredited registrars, QMI and KPMG. PricewaterhouseCoopers is currently going through the application process (Johnson 2002, Rotherham et al. 2000). Product labels were approved as of June 2001 (CSA 2001).

The Pan European Forest Certification (PEFC) Council is a voluntary private sector initiative, initiated in August 1998 and officially founded in June 1999. Until now, this management system-based scheme has operated mainly in Europe. However, it has a global scope and will be administered worldwide (PEFC 2001, Hansen et al. 2000). Standards are developed nationally by the member countries and then submitted to the PEFC Council Board for approval. National accreditation organizations accredit certification bodies to perform the audits. Certified institutions are allowed to use PEFC logo on their products and/or product documentation (PEFC 2001).

Standards created by each of the major certification organizations have the purpose of serving as guidelines for the assessment of forestry practices. If forestry activities are in accordance with the respective sustainable forest management principles, a forest management certification is issued. However, some certification organizations have also developed standards that guide the monitoring and inspecting of all the links between the forest and the final consumer. These kinds of standards lead to chain of custody certification (Viana et al. 1996, SmartWood 2001). The choice between forest management certification and chain of custody certification will depend on the specific characteristics of each company, especially with respect to its position in the supply chain. The FSC, CSA, and PEFC are currently the only certification organizations that have developed standards for chain of custody assessment. SFI has approved rules for the creation of an on-product label, but its use has not yet been authorized (Meridian Institute 2001).

2.3. FOREST CERTIFICATION AS A MARKET ACCESS TOOL

Marketing has an important social and economic role in society. In the latter case, the marketing process stimulates the consumption of goods and services, activating economic development. Marketing also has a social role, informing customers about the availability of goods and services that will improve their quality of life. However, the actual patterns of consumerism based on disoriented production and consumption of goods lead to a heavy impact on environmental resources (Sheth and Parvatiyar 1995).

Some initiatives for improving marketing's impact on the natural environment have been developed and the concept of sustainable development has been an important guide. Considering marketing's social and economic roles, its contribution to sustainable development will have to be based on two important strategies: (1) to educate and shape customers' needs and expectations with regards to environmentally beneficial products; and (2) to provide goods and services that meet these expectations (Sheth and Parvatiyar 1995). This new marketing approach is called "environmental marketing" and it can be better defined as marketing activities that consider environmental stewardship as both a business opportunity and corporate responsibility (Coddington 1993).

The development of environmental marketing concept is a consequence of recent public concerns regarding environmental preservation. These concerns created potential marketing opportunities and one of the main objectives of environmental marketing is to communicate the ethics of a company and the environmental quality of a certain product to consumers. Product certification is considered one of the most efficient ways of communicating these aspects of a company/product (Wasik 1996, Coddington 1993). As a result, different kinds of certification have been developed for several types of products and their packaging (Coddington 1993). Forest products certification was the specific response of the forestry sector. It is a voluntary program based on the belief that consumers of forest products are likely to put a greater value on organizations committed to proving their protective attitudes towards the natural environment.

Consequently, forest certification has the double objective of "(a) working as a marketing incentive to improve forest management, and (b) improving market access and share for the products of such management" (Upton and Bass 1996).

The initial idea was that demand for environmentally friendly products would be translated into premium prices (Jenkins and Smith 1999). Following this assumption, several studies investigating customers' willingness to pay these premium prices showed positive results (Ozanne and Smith 1995, Ozanne and Vlosky 1997, Forsyth et al. 1999). However, an expressed willingness to pay does not always translate into purchase behavior (Sheth and Parvatiyar 1995, Hansen 1997). In a survey of US merchants of certified forest products, Humphries et al. (2001) verified that the majority of the respondents did not receive any premium prices at all when selling their certified products. Some researchers consider that the lack of premium prices is due to market immaturity (Humphries et al. 2001). Others say that the existence and the amount of premium paid for certified products depends on the base price of the product: the more expensive the product is, the smaller premium for that product will be (Humphries et al. 2001, Vlosky et al. 1999). Despite disagreement on this topic, the fact is that the consumer group for certified wood products is growing and is likely to continue expanding (Teisl et al. 2002). However, Hansen (1997) states that there is little evidence to suggest mass demand for certified forest products. Currently, much of the demand for certified forest products has been generated through niche markets and large retailers that favor suppliers offering certified products (Ozanne and Vlosky 1997, Hansen and Juslin 1998, UN/ECE Timber Committee 2000, Jenkins and Smith 1999).

Even though premium prices are generally thought of as the main general benefit for certified forest products companies, other benefits can come from forest products certification. Investments in environmentally responsible activities like forest certification can be translated into improved competitive advantage. According to Miles and Covin (2000), companies that invest in socially and environmentally responsible activities may enhance their financial performance. This is explained by the fact that these types of investments improve the reputation

of a firm. A firm's reputation is the result of stakeholders'[2] perceptions of the quality of its management (Hammond and Slocum 1996) and is a function of credibility, trustworthiness, reliability, and responsibility (Fobrum 1996 cited by Miles and Covin 2000). Superior reputation generates reputational advantage, which may result in benefits like lower perceived risk and enhanced marketing opportunities (Miles and Covin 2000, Hammond and Slocum 1996). Investments in environmentally and socially responsible activities demonstrate a firm's sensitivity to external events, which means that the firm is able to anticipate and 'control' its changing environment. Investors may perceive this type of firm as a lower risk investment opportunity (Hammond and Slocum 1996). Furthermore, enhanced marketing opportunities, such as the chance to target environmentally sensitive markets, may result in: (1) protection of market share; (2) pricing concessions; and (3) increased strategic flexibility (Sinclair 1992, Upton and Bass 1996, Miles and Covin 2000). The possibility to exploit profitable marketing opportunities, in addition to a lower perceived risk, may serve to increase the market value of a firm certifying wood products, and thus its profitability (Miles and Covin 2000) (see Figure 2-2).

The relationship between reputational advantage and financial performance of a firm has been widely discussed in the literature (Miles and Covin 2000, Hammond and Slocum 1996, Russo and Fouts 1997, Menon and Menon 1997). It should be noted that this section summarized only the key points in an attempt to explain how forest certification can function as a market access tool.

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[2] Stakeholders are usually represented by investors, corporate managers, recruiters, employees, and customers.

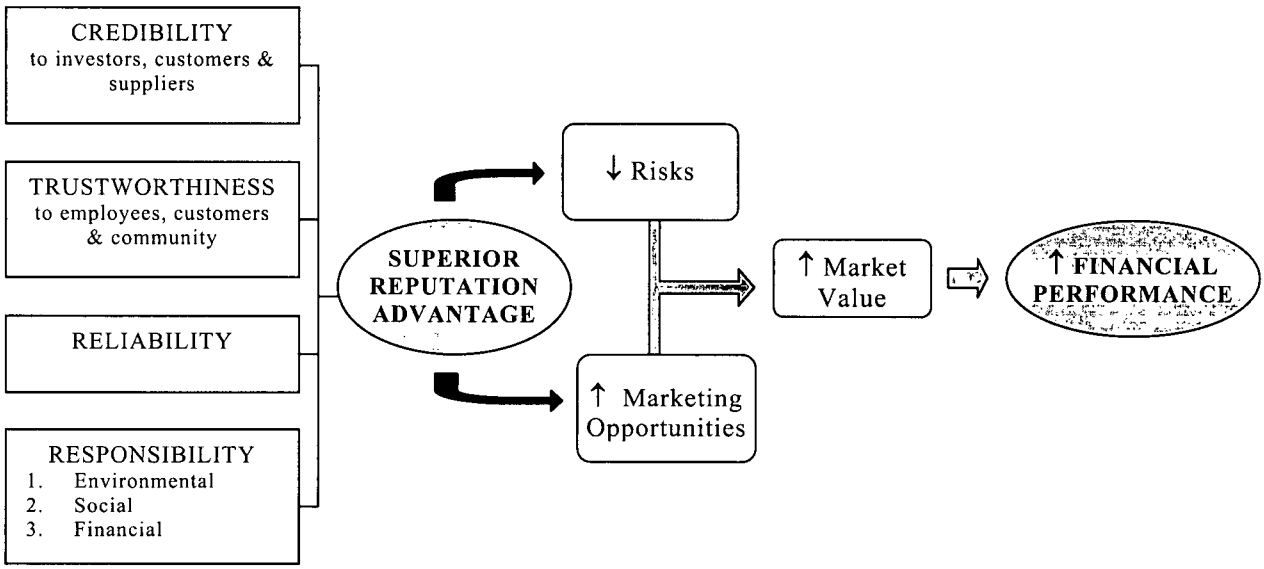

Figure 2-2: Impact of reputational advantage on the financial performance of a firm (adapted from Miles and Covin 2000).

2.4. CHAIN OF CUSTODY CERTIFICATION

2.4.1. Definition and Importance of Chain of Custody Certification

Public concern about environmental issues not only affects forest companies and their forestry practices but also affects companies along the supply chain that use wood as a raw material for their products. The concept of chain of custody is used in forest certification as an identification tool for products manufactured with certified wood. Chain of custody is a concept used in different areas and can be generally described as a process used to maintain and document the history of facts. It has been long used in areas such as legal services where it is necessary to identify each person having custody of evidence as means of proving the integrity of the evidence collected (Morris 1998).

Recently, chain of custody has been an important tool in the electronics industry. The use of internet and network resources has grown considerably among individuals and institutions. In general, these resources are used for several purposes, from simple communication to important trade transactions. However, criminal actions through these resources are also increasing, and several cases are left unsolved due to the lack of integrity of electronic evidence. Therefore,

chain of custody is being used as a tool "by which computer forensics specialists preserve the crime scene" (MSNBC 2000). Chain of custody is also used in security management of all types of facilities in order to keep control of materials, equipment, and products. Logistics operations also use chain of custody as a tool for inventory control (Albright 1998, Johnson and McCatty 1998).

Chain of custody has been playing an important role in environmental protection. Public concern about environmental destruction also affects agriculture-related sectors like the food and textile industries. In the case of textiles, conventional methods of cotton production are usually associated with environmental and health costs. The concern and pressure of industrialized countries about the environmental impact of cotton production and processing is resulting in changes towards "sustainable alternatives such as organic cotton, integrated pest management and chemical free processing" (Robins and Roberts 1998). Certification processes for organic cotton production were established and chain of custody is used as a guarantee that the cotton is really produced according to sustainable standards.

The case of the textile industry is very similar to forest certification. Like the textile industry, FSC, CSA, and PEFC have developed standards for chain of custody certification. Chain of custody certification is an inventory control process with the objective of assuring that the wood or the forest product purchased really comes from a environmentally certified source (Upton and Bass 1996, Groves et al. 1996, Estey 2000, Certified Woods Products Market 2000).

Chain of custody certification is an important component of certification systems because it provides the link between the customers and producers of certified forest products (Groves et al. 1996). However, it is extremely complex and causes a great deal of confusion and misunderstanding for companies considering implementing chain of custody strategies. Jenkins and Smith (1999) emphasize that critics of forest certification generally address chain of custody requirements as being too complicated. As a result, chain of custody certification has been responsible, at least in part, for many companies reluctance to become certified (Hansen and Juslin 1998).

2.4.2. Technical Aspects of Chain of Custody Certification

Chain of custody certification requires easily interpreted records and physical evidence like tags and labels to identify and segregate materials (Certified Wood Products Market 2000). There are usually two requirements for a well-functioning chain of custody: (1) a documentation system needs to be in place; and (2) all of the material being traced must be properly identified and segregated (Upton and Bass 1996).

Groves et al. (1996) identified the most common methods of installing a documentation system. Recording information on paper was described as the most traditional and the most common way of capturing, communicating, and auditing data associated with the materials used. However, they also stated that computers are rapidly gaining acceptance due to their ability to store "large volumes of information that can be readily accessed and cross-referenced."

Groves et al. (1996) also described some of the methods and technologies used to identify the origin, species, and volume of wood materials coming from a forest. Paint, hammermarks, labels, and latschbacker tags were identified traditional techniques. Paint was described as being the most common type of marking; it can be used to indicate the forest of origin, species, and volume. Hammermarks are "commonly used to mark logs to verify measurements taken at the time of felling." Labels are similar to painting because they can display the same information, but can be removed much more easily, especially in water. Latschbaker tags are numbered plastic tags; they contain only a number, so that information about the material must be stored elsewhere.

Some new techniques, such as barcoding, radio-frequency identification devices, and touch memories, are also described and briefly explained by Groves et al (1996). According to the authors, barcoding is the most common method used and consists of barcode labels affixed to the material. They can be read by a barcode scanner attached to a personal computer. They provide fast and accurate information about the material, and are extremely safe to use. Radio-frequency identification devices are "pre-programmed computer chips that incorporate a small

area through which data can be received or transmitted." However, they are currently still too expensive to be used widely. Touch memory is a battery-powered computer chip in a circular metal housing. It can store the equivalent of one page of text that can be easily read with a touch memory reader attached to a personal computer (Groves et al. 1996).

The process of chain of custody itself includes several steps, depending on "the range of sources, the complexity of the manufacturing process, and the type of market into which the product is sold" (Upton and Bass 1996). Groves et al. (1996) identified and divided chain of custody into three key stages: (1) from the forest to processor/manufacturing mill; (2) during the processing/manufacturing stage; and (3) from processing to the marketplace. They explain that the first stage of chain of custody usually involves developing a technique to trace the product from the forest to the processing center. The emphasis on the second stage is placed on monitoring the material through the mill during the manufacturing of the product. Finally, in the third stage, the product "may be packaged, stamped with a label or identifying tag, and/or shipped in a banded bundle." The products are usually accompanied by documents such as invoices, bills of lading, or a General Agreement on Tariffs and Trade (GATT) Form A Certificate of Origin. These documents provide an auditable trail, which can be used to trace the product to its origin.

2.4.3. Supply Chain Management and the Consequences of Chain of Custody

Supply Chain Management (SCM) is a business management theory introduced in the late 1950s. The SCM philosophy considers the supply chain as a single institution rather than as a set of fragmented parts working individually. Furthermore, it considers that "each firm in the supply chain directly or indirectly affects the performance of all the other supply chain members" (Mentzer et al. 2001).

Mentzer et al. (2001) defined SCM as "a systematic, strategic coordination of traditional business functions within a particular company and across businesses within the supply chain, for the process of improving the long-term performance of the individual companies and the

supply chain as a whole." They added that an effective implementation of SCM requires that all supply chain members: (1) mutually share information, rewards, and risks; (2) cooperate with each other; (3) have the same goals and the same focus of serving customers; (4) integrate their processes; and (5) create long-term partnerships (Mentzer et al. 2001).

Companies establish SCM with the objective of enhancing their competitive advantage. Successful SCM leads to a reduction in costs due to improved operational efficiencies and an increased customer focus. Together, this will result in improved customer value and satisfaction, and thus profitability (McDougall 1999, Cross 1999, Borck 2001, Mentzer et al. 2001).

Like SCM, chain of custody certification requires an integrated effort on the part of all members of the supply chain in order to provide the end consumers with products and services that will satisfy their needs and wants (environmentally friendly products in this case). Chain of custody certification creates increased customer value with respect to the consumer's perception of how well the product purchased meets his or her expectations (Nix 2001). In theory, this customer value will generate a competitive advantage that results in improved profitability (Mentzer et al. 2001).

Groves et al. (1996) and Upton and Bass (1996) reaffirm this concept in discussing possible benefits of chain of custody certification. According to these authors, the chain of custody process can bring about management advantages as a result of the need for better information systems; more complete information about materials can be accessed more rapidly, which can, in turn, provide better inventory control, as well as more precise and clear information to investors. Finally, more direct communication amongst all of the actors in the supply chain will likely result in an increased understanding of potential markets.

SCM can also present problems related to mutual trust among the members of the chain. Sharing of information, risks, and rewards requires a great deal of trust, which can be very difficult to develop (Mentzer et al. 2001). The implementation of chain of custody strategies deals with such problems. However, there are very specific problems that occur within the forestry sector. Some authors (Upton and Bass 1996, Vlosky and Ozanne 1995, Groves et al.

1996, Hansen 1997, Hansen and Juslin 1998, Estey 2000) consider the total costs of implementing and maintaining chain of custody certification to be a major problem. Segregating the material that comes from different sources usually results in high costs (Hansen 1997; Hansen and Juslin 1998; Estey 2000). Upton and Bass (1996) refute this idea, stating that "the necessity of segregation can be reduced if an easy and efficient identification system of the material is established." However, material segregation is not the only source of costs. Vlosky and Ozanne (1995) estimated that chain of custody trail audits usually generate significant expenses as well. However, they did not specify the types of expenses they are referring to.

"Gatewood" was identified as another frequent problem in implementing chain of custody (Groves et al. 1996, Estey 2000). This term refers to the raw material that arrives at the "gates" of a manufacturing facility with little or no information pertaining to the original source. It is usually linked to the supply of products from small land ownership.

2.4.4. How Chain of Custody Certification Works

The previous sections explored the definition and importance, the technical aspects, and the possible consequences that chain of custody certification may have for forest products companies. The process of implementing a chain of custody may seem very complex due to the need for tracing the wood material and documenting every move it makes through the supply chain. An example will be presented in this section in order to group most of the information presented previously and to facilitate the understanding of the process.

The chain of custody process has several steps. The number of steps depends on the characteristics of each company in the supply chain and on the market target by these companies (Groves et al. 1996, Upton and Bass 1996). It is the responsibility of each organization in the chain to establish a process of identification and recorded information of the certified wood material in question (Upton and Bass 1996). These procedures should be unique and created according to the scale of each organization. The records will be used to easily "trace the product

to its immediate source; original shipment and/or batch; and certified source of origin" (Upton and Bass 1996).

Upton and Bass (1996) presented an example of chain of custody for the production of doors from rubberwood for export (Figure 2-3). There were three parties involved in the chain of custody process in question: the producer of certified rubberwood, Supplier 1 (primary processor), and Supplier 2 (the door manufacturer). The producer of certified rubberwood must have the appropriate documentation delivered to the Supplier 1 at the time of the sale. After receiving the certified rubberwood from the producer, Supplier 1, who is the primary manufacturer, should go through two sets of documentation: one regarding the harvesting process and the second regarding the primary processing of the wood. The specific information each type of documentation should contain is specified in Figure 2-3.

Supplier 2, the door manufacturer, will have a set of documentation and procedures for each stage of the manufacturing process. The first stage consists of documentation of transporting and receiving the sawnwood at the secondary facility. Next, comes the kiln drying stage followed by the storage of dried rubberwood. From the storage, the kiln dried rubberwood goes to the moulding and door assembly department. After the product was assembled, the shipping department needs to prepare the transportation documents. Finally, the accounting department prepares the last set of documents before the product is exported (see details in Figure 2-3).

There are important points that must be followed by the chain of custody certified supply chain. First, it is very important that, in each stage of the process, the output stay into a reasonably percentage of the input amounts. This means that "the quantity of certified material bought by the organization should approximate to the amount sold after allowing for processing losses" (Upton and Bass 1996). Second, all the rejects resulted from the manufacturing and transportation processes must be registered. Finally, the output must have a sequential serial number that can be used to relate it back to the inputs of fresh wood (Upton and Bass 1996). Since good documentation is the essential element of a successful chain of custody, it is

recommended that each organization in the chain maintain the following records: purchase records, stock records, production records, and sales records (Upton and Bass 1996).

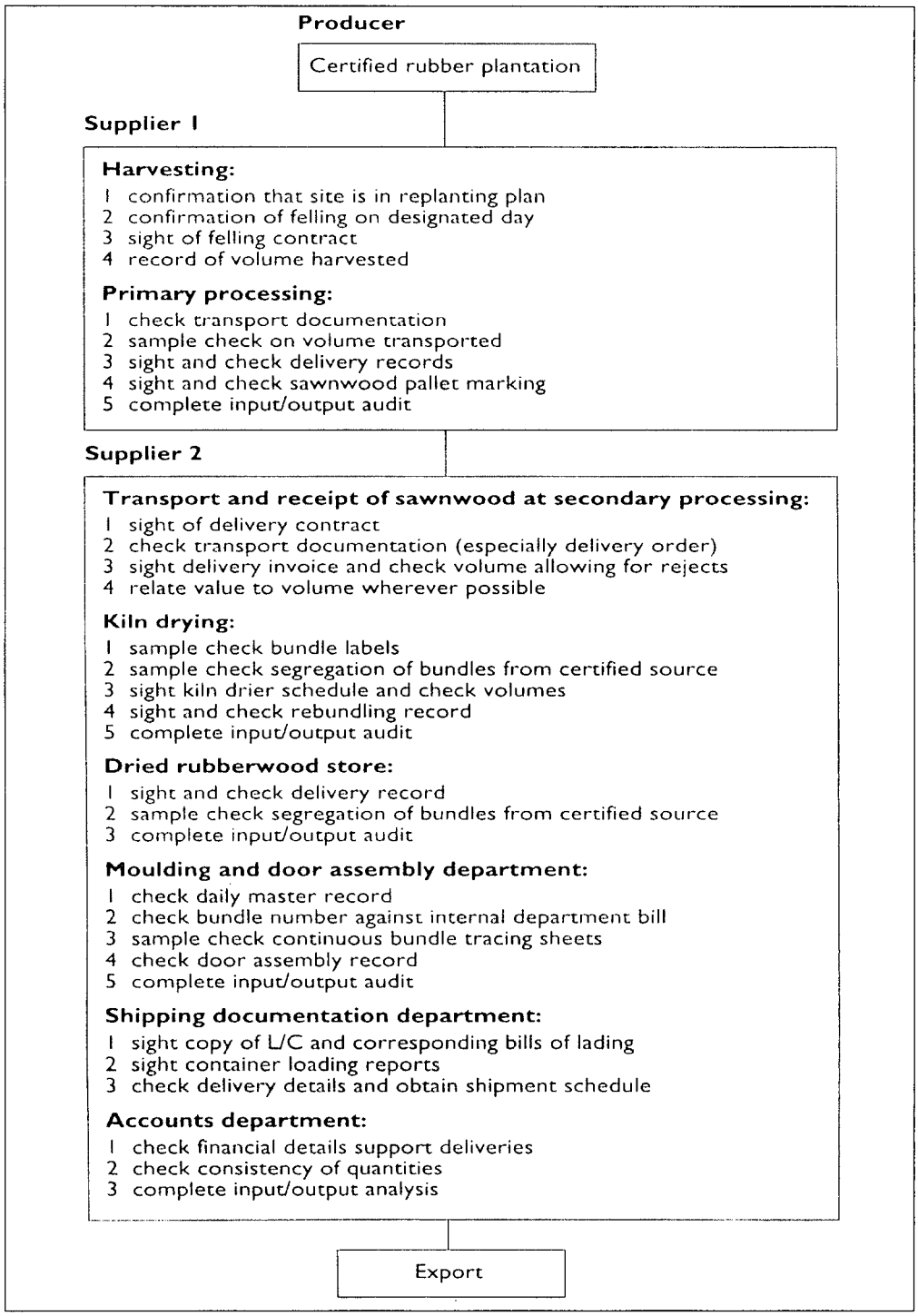

Figure 2-3: Identification of chain of custody with regard to the manufacture of doors from rubberwood. Source: Upton and Bass 1996.

2.5. PROBLEM STATEMENT AND OBJECTIVES

Several questions surround chain of custody certification procedures, strategies, and consequences. Forest products companies may not have enough information about chain of custody to make a decision on whether or not they should implement it. Therefore, this study aims to determine the level of knowledge of non-certified companies and the current status of chain of custody certification in Canada and the United States.

Chain of custody is a relatively new topic in forestry, especially when related to commodity markets like lumber. With the recent attention that forest products certification is receiving, forest companies are now required, more than ever, to consider this issue. However, the majority of the wood industry in North America considers the implementation of chain of custody to be too complicated (Jenkins and Smith 1999). Part of this complexity can be explained by the fact that chain of custody involves elements that are sometimes outside of the landowners' control (Estey 2000). Information on chain of custody certification usually describes *possible* results and consequences that it could have on companies and no further studies have been conducted to verify these assumptions. This lack of knowledge on the actual characteristics and consequences of the process has led to skepticism from companies, slowing the adoption of chain of custody certification.

Information on how much companies know about chain of custody certification and the effects that it is having on certified forest companies can provide strong support for further developments in this area. Information on the benefits accrued by certified companies and the costs of the entire process can provide other forest companies with a stronger base for making decisions regarding investing in chain of custody certification. Furthermore, a through analysis of chain of custody issues may lead to the identification of important gaps not realized before. The results may also serve as incentives and guidelines for the development of further research on this subject. Finally, it will provide benchmarking data on the importance and evolution of chain of custody certification for companies in the first decade of its existence.

The main objective of this research is to determine the actual status of chain of custody certification in primary wood industries in Canada and the United States. The following specific objectives will be achieved:

1. To assess the current and expected adoption levels of chain of custody certification;
2. To assess the level of knowledge and perceived benefits/costs that non-certified companies have about chain of custody certification;
3. To examine the requirements of implementing chain of custody certification, including costs, methods and technologies used, and the resulting benefits.

3. METHODOLOGY

3.1. THE APPROACH

The research conducted in this study took place in two distinct phases. First, a mail questionnaire was designed and sent to primary wood products manufacturers in Canada and the United States. The second phase consisted of telephone interviews with accredited certification bodies in Canada and the United States.

Both chain of custody certified and non-certified companies were part of this study. The participation of non-certified companies was necessary to assess the level of knowledge and the costs/benefits that these companies expect from chain of custody certification. Chain of custody certified companies were important in providing information on costs, methods and technologies used, and benefits. Finally, both certified and non-certified companies were required to provide information on current and expected adoption levels of chain of custody certification.

Accredited certification bodies were included to complement information provided by companies. Certification bodies that do chain of custody assessments, as well as those that will likely be doing it within the next five years, participated in the survey.

3.2. DEFINITION OF POPULATION

The first phase of this study concerned primary wood producers of pulp logs, veneer logs, lumber, timbers, and veneers. Both chain of custody certified and non-certified primary wood products manufacturers from Canada and the United States were part of this survey. A list of 204 chain of custody certified companies in these two countries was obtained from the accredited certification bodies. Since it was a small population, all companies were included in the survey. A list of 3,150 non-certified companies from both Canada and the United States was obtained from two industry directories: Wood Technology (1999) and Forest Source (2002). A total of 796 companies were randomly selected from this list, bringing the total sample frame to 1,000 companies. Different reasons led to the choice of this number of companies. First, a greater response rate was expected from the certified companies since it was thought that they would

have interest in the topic of chain of custody certification. Thus, considering a 10% to 15% response rate for the non-certified companies and a 40% to 50% response rate for the certified ones, similar numbers of companies of each segment could be analyzed. Finally, this number was chosen because of budgetary constraints.

A list of eight accredited certification bodies that administer chain of custody assessments in Canada and the United States or will be likely doing it within five years was obtained from major certification organizations. The population is very small; thus, all eight organizations were included in this phase of the study.

3.3. SURVEY DESIGN

3.3.1. Mail Questionnaires

A mail questionnaire was designed to survey chain of custody certified and non-certified companies (see Appendix I). The questionnaire had a total of 27 questions divided into four different sections. Section 1 was designed to collect information on adoption levels and the levels of knowledge of non-certified companies. The first question of this section intended to separate the certified respondents from the non-certified ones, with the certified companies asked to proceed to Section 2 of the questionnaire. The other questions in this section were addressed to non-certified companies. These questions collected information on the companies' intent to become certified, levels of knowledge about chain of custody certification, expectations regarding the costs of certification, considerations of potential markets for certified products, perceived benefits resulting from the certification process, and reasons for choosing not to become certified.

The second and third sections of the questionnaire were directed only to certified companies. Section 2 aimed to collect information on companies' customers and products (certified or not), technologies used to track material sources, costs of the process, and types of certification standards used. The third section was directed to collect information on the benefits and difficulties resulting from the chain of custody certification process.

Profile information was collected in the fourth and last section of the questionnaire. Information such as companies' locations, sales revenues, number of employees, and total number of product lines was gathered in this section.

The definitions of primary wood products and chain of custody certification considered for this project were placed on the top of the first page of the questionnaire. Companies to which the definition of primary wood products did not apply were asked to check the box "Does NOT Apply" and return the questionnaire to us. Those respondents that wanted a copy of the results of this study could include their names and addresses in the space provided at the bottom of the last page.

3.3.2. Telephone Interviews

The accredited certification bodies were surveyed by telephone interviews (see Appendix II). This interview was composed of an introduction and four sections. The introduction had the purpose of verifying the number called, identifying the interviewer, explaining the project, and informing the respondent about the duration of the interview.

Section 1 contained questions concerning adoption level of primary wood products companies that are chain of custody certified. The questions verified if the certification body does chain of custody assessments; and determined the number of companies that have been certified and the number of companies currently in the process of doing so.

Section 2 concentrated on the costs of chain of custody certification. Respondents were asked to identify how companies were charged for chain of custody certification and to estimate the range of costs for chain of custody assessments, annual audits, and certification renewals.

The benefits that companies can acquire from chain of custody certification were assessed in Section 3. Section 4 aimed to collect information on the organization profile. Questions in this section served to identify the organizations' locations. Respondents were also offered the option of requesting a copy of the results. If they were interested in receiving a copy of the results, they were asked to provide their names and addresses.

3.3.3. Cover Letters

Three letters were designed for the mail questionnaire (see Appendix III); each letter was mailed in different phases of the implementation process. All three letters had basically the same purpose: presenting and explaining the project, requesting and explaining the importance of their voluntary participation, guaranteeing respondent anonymity, offering contact information, and in the case of the second letter, thanking the respondents for their participation.

The differences between the letters related to the different phases of the implementation process. The letter for the first mail out mainly intended to present the study. The letter of the second mail out aimed to thank the participants that had already responded and ask those that had not to do so. The letter of the third mail out had a more desperate tone and aimed to emphasize the importance of their participation for the success of this study.

An advance letter was designed to notify the accredited certification bodies of the telephone interviews (Appendix III). This letter had the objective of eliminating the surprise element, providing evidence that the interviewer is doing legitimate research, providing a concise description of the study, and offering contact information (Dillman 1978).

3.3.4. Other Considerations

The Behavioral Research Ethics Board of the University of British Columbia issued a Certificate of Approval of the surveys and letters listed above on January 29th, 2002. This approval declared that the surveys and letters for this project had been reviewed by the Ethics Committee and were in accordance with ethical grounds for research involving human subjects.

3.4. IMPLEMENTATION

The telephone interview and the written questionnaire were implemented independently. Each process is presented in separate sections below.

3.4.1. Mail Questionnaire

The implementation process of the mail questionnaire followed the principles set forth by Total Design Method (Dilemmas 1978). This method has the objective of increasing response rates and was slightly modified to fit the conditions of this study.

Three mail outs were made from UBC. The first mail out included the survey, a cover letter, and a pre-paid return envelope and was sent on May 10th, 2002. The second mail out consisted of a letter only and was made two weeks after the first one on May 24th, 2002. The last step consisted in mailing out the survey, a cover letter, and a return envelope to those participants that had not responded the first two mail outs. This mail out took place one month after the first one on June 7th, 2002.

The survey was printed in a professional booklet format by Benwell Atkins Ltd. – Printers and Mailers, who also printed the letters and envelopes. The surveys for the first mail out were coded from 0001 to 1,000 in order to keep track of respondents. Pre-paid business reply return envelopes were used in Canada and delivered to Benwell Atkins. The ones sent to the American companies had stamps with the sufficient postage to be mailed back to Benwell Atkins. Responses were collected for three weeks after the first mail out. Only companies which did not respond the first two mail outs were contacted a third time.

3.4.2. Telephone Interviews

The advance letters were sent to the participating certification bodies on May 14th, 2002. The interviews took place from May 24th to 29th, 2002. Each interview had a duration of between five and twenty minutes, depending on the involvement of the organization with chain of custody certification. In some institutions, several calls were made in order to contact the right person for the interview. When asked if the time was appropriate for them to answer the interview, most of the respondents asked to be interviewed at another time. Interviewees were generally very receptive and demonstrated goodwill when responding to the questions.

3.5. DATA ANALYSIS

Both descriptive and inferential statistics were used to analyze the data collected in the mail and telephone surveys. The analysis plan was defined in accordance to the types of scales used in each question as well as the research question posed in this project. Multivariate techniques were used in order to analyze data sets consisting of multiple variables.

The data analysis for each survey is described below. SPSS 10.0 and Microsoft Excel 97 were the software used to do these analyses.

3.5.1. Mail Questionnaires

Some of the mail survey questions collected information on nominal data: simple dichotomy questions (i.e. yes/no questions), preference for certification bodies, market identification, types of technologies used, and company location. These data were analyzed using frequency calculations.

Data from Likert scale questions was used to compute means and standard deviations. Questions that requested the respondents to indicate their level of agreement on the possible benefits of chain of custody fell into this category. Ninety-five percent confidence intervals were computed for the means of each statement. Each mean was also tested against a neutral point in order to verify whether the means were significantly different from "3" (alpha level of 0.05), the point in the scale that indicates a neutral attitude.

Ratio data was also collected: proportion of certified raw material used, sales revenue, number of suppliers, number of employees, etc. Relative and cumulative frequencies were used to analyze these data.

Questions relating to costs and difficulties of chain of custody certification asked the respondents to rank their answers from 1 to 3, with 1 being the highest rank. The ordinal nature of this data does not allow for the use of inferential statistics; therefore, rank order was used to do the analyses. Finally, questions collecting information on the costs of each phase of the chain

of custody process involved categorical scales. These were analyzed using tallies and proportions.

A cluster analysis was also conducted in order to identify the type of companies that are most likely to perceive/obtain benefits from chain of custody certification. Questions 9 (Section 1) and 2 (Section 3) were identical questions asked in different sections in order to reach all types of respondents (certified and non-certified). The answers to these questions merged in order to run the cluster analysis.

A partitioning or non-hierarchical technique was used to analyze this data. K-Means clustering is the partitioning technique offered by SPPS 10.0 for Windows and is a suitable technique for larger data sets like the one of this study (LeMay 2001). The clustering procedure of this technique constitutes of searching for "a partition with small error component E by moving individuals from one cluster to another until no transfer of an individual results in a reduction in E" (Dillon and Goldstein 1984). K-Means clustering requires the number of final cluster to be known and specified in advance. The existence of different groups was verified as well as the aspects that differentiate them.

A discriminant function analysis was computed for certified and non-certified companies. This type of analysis has the primary objectives of finding "the dimension or dimensions along which groups differ, and to find classification functions to predict group membership" (Tabachnick and Fidell 2001). Discriminant function analysis was used in this study in order to find out how the groups of chain of custody certified and non-certified companies differ from each other based on sales revenue, number of employees, and number of product lines. This analysis was also used to specify classification functions to predict group membership.

3.5.2. Telephone Interviews

The data collected by telephone interviews was analyzed through descriptive statistics like means, standards deviations, and proportions. Most of the data collected by the telephone survey consisted of nominal data; these data were tallied and described. Finally, these data were

collected in order to provide insights and back up information for the results of the mail questionnaire sent to companies.

4. RESULTS

4.1. MAIL SURVEYS

4.1.1. Types of Responses

One thousand questionnaires were mailed out to primary wood products companies in Canada and the United States. Participating companies mailed back 270 questionnaires. These questionnaires were divided into two groups: complete and incomplete surveys. A definition of what was considered primary wood products was placed on the top of the first page of the questionnaire. Respondents for whom this definition did not apply were asked to check the box "Does NOT apply" and return the questionnaire. These questionnaires and those that had one or more required sections that were left in blank were classified as "non-complete" responses. Frequencies and relative frequencies were calculated for complete and non-complete questionnaires and can be seen in Tables 4-1 and 4-2. More than half (59%) of the responses were complete responses; the remaining 41% of responses were non-complete (Table 4-1). Seventy-six percent of the respondents who did not complete the questionnaire stated that the survey did not apply to them (Table 4-2). In total, 158 complete questionnaires were used for further analyses.

Table 4-1: Number and type of responses.

	Complete Questionnaires	Non-Complete Questionnaires	Total
Frequency	158	112	270
%	59%	41%	100%

Table 4-2: Number and type of non-complete responses.

	Does Not Apply	Blank Sections	Total
Frequency	85	27	112
%	76%	24%	100%

4.1.2. Response Rates

The response rate for the written questionnaire was calculated in two different ways depending on how non-complete questionnaires were accounted for. The first method did not consider non-complete questionnaires as responses, while the second method did.

Response rate (RR) using the first method was calculated as follows:

$$RR = \frac{\text{Complete Responses}}{\text{Total Mail Outs} - \text{Returns} - \text{Non-Complete}}$$

Response rate using the second method was calculated as follows:

$$RR = \frac{\text{Complete Responses} + \text{Non-Complete}}{\text{Total Mail Outs} - \text{Returns}}$$

A total of one thousand questionnaires were mailed out. Of the 270 responses received, 158 were complete responses, 112 were non-complete responses, and 64 were returned to sender because of changed or non-existent addresses. The response rate calculated with the first method was 19.17%. By considering non-complete questionnaires as valid responses, the response rate was 28.85%. A wide range of acceptable response rates is found in the literature, varying from below 20% to 100% (Babbie 2000). In this case, both response rates are considered acceptable for drawing inferences on the population of primary wood products industry in Canada and the United States (Miller 1977, Babbie 2000).

4.1.3. Non-Response Bias

The sampling process may produce errors that result in a sample that is not representative of the population. This non-response bias occurs when those people who did not respond to the questionnaire differ in significant ways from those that did (Kanuk and Berenson 1975). In order to test for non-response bias, the data set was divided into two groups according to the arrival dates of each response: responses from the first mail out and respondents from later mail outs (Armstrong and Overton 1977). Data from the early respondents were combined and tested

against the data from the later respondents. Specifically, proportions of certified and non-certified companies, average sales revenue, and average number of employees were compared for the early and late groups (Table 4-3).

Table 4-3: Variables tested for non-response bias.

	Early (n = 83)	Late (n = 75)
Certification Status		
Certified	43.37%	34.67%
Non-Certified	56.63%	65.33%
Average # of Employees	127.31	164.22
Average Sales Revenue	$26,901,030.77	$32,504,194.29

A z-test was used to compare the proportions of certified and non-certified companies in the two groups. At an alpha level of 0.05, there was no significant difference between the proportion of certified companies in the two groups.

Z-tests for means were used to compare the average number of employees and the average sales revenue of the two groups since the sample sizes in each group exceeded 30. At an alpha level of 0.05, there were no significant differences between the number of employees and the sales revenue of the two groups.

The fact that there were no statistical significant differences detected by these tests indicates that there is no sign of non-response bias. Therefore, statistical inferences can be drawn from the results of this study.

4.1.4. Current and Expected Adoption Levels for Chain of Custody Certification

Respondents were asked to specify whether they were chain of custody certified. Frequencies and relative frequencies were computed and are seen in Figure 4-1. Thirty-nine percent of the respondents stated that their companies were chain of custody certified. Ninety-five percent confidence intervals were computed for the proportions of certified and non-certified companies. The confidence intervals for the proportions of certified and non-certified companies are 0.39±0.08 and 0.61±0.08, respectively. Of the 61% of the respondents that were not chain of custody certified, the majority (81%) have no intention of becoming chain of

custody certified within the next five years. The ninety-five confidence interval for the proportion of companies that do not plan on becoming certified within the next five years is 0.81±0.08.

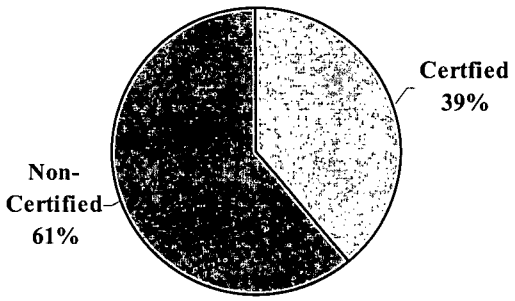

Figure 4-1: Adoption level of chain of custody certification.

4.1.5. Respondent Profiles

Respondents were asked to indicate the approximate sales revenue for their companies in 2001 in US dollars. Responses were divided into nine classes (based on the categories in the questionnaire) and relative frequencies were computed for each class (Figure 4-2). The majority of respondents (approximately 57%) had sales revenues of between US$1.1 and US$25 million in 2001.

Relative and cumulative frequencies of certified and non-certified companies were computed for each class (Table 4-4). Approximately 54% of the non-certified companies had sales revenues of less than US$5 million. In general, certified companies had higher sales revenues in 2001, with 64.6% of the companies having sales revenues of up to US$25 million.

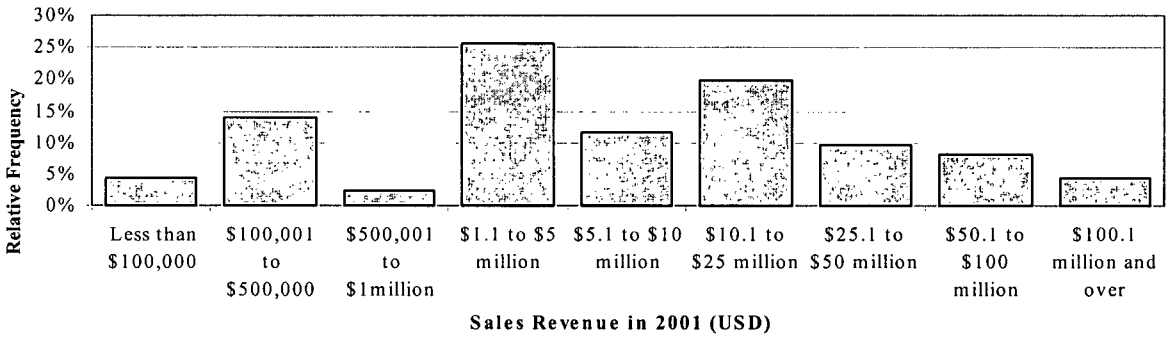

Figure 4-2: 2001 sales revenue of respondents.

Table 4-4: Sales revenue in 2001 for chain of custody certified and non-certified companies.

Sales Revenue in 2001 (USD)	Certified (n = 48)		Non-Certified (n = 67)	
	Relative Frequency	Cumulative Frequency	Relative Frequency	Cumulative Frequency
Less than $100,000	4.2%	4.2%	4.5%	4.5%
$100,001 - $500,000	10.4%	14.6%	13.4%	17.9%
$500,001 - $1,000,000	0.0%	14.6%	4.5%	22.4%
$1,000,001 - $5,000,000	14.6%	29.2%	31.3%	53.7%
$5,000,001 - $10,000,000	12.5%	41.7%	7.5%	61.2%
$10,000,001 - $25,000,000	22.9%	64.6%	20.9%	82.1%
$25,000,001 - $50,000,000	12.5%	77.1%	9.0%	91.0%
$50,000,001 - $100,000,000	16.7%	93.8%	4.5%	95.5%
More than $100,000,001	6.3%	100.0%	4.5%	100.0%

Respondents were asked to identify the number of employees working in their companies. The median was used as measure of central tendency due to the skewness of the distribution (Figure 4-3). The median number of employees per company is 35. Results were also separated into seven classes and frequencies were calculated for each class (Figure 4-3). Thirty-seven percent of the companies have up to 20 employees working for them, and 24% have between 21 and 50 employees. Only 39% have more than 50 employees.

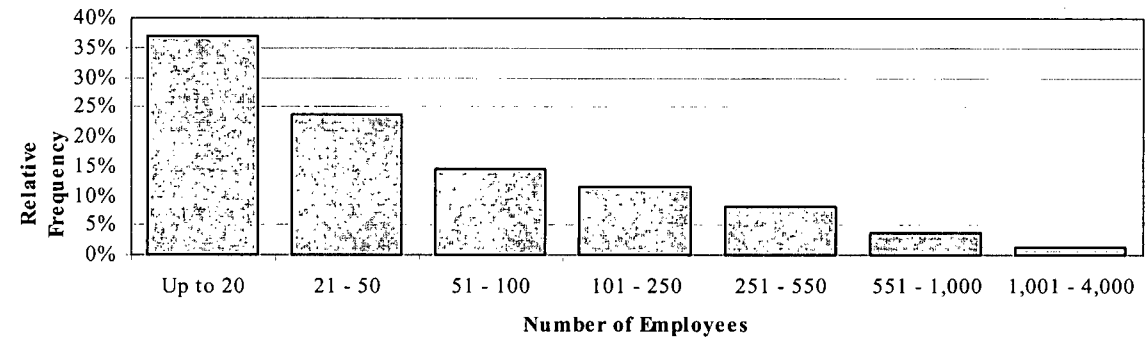

Figure 4-3: Number of employees in respondents' companies.

Results relating to the number of employees were also computed separately for certified and non-certified companies. Relative frequencies for the same seven classes seen in Figure 4-3 were computed for each class (Figure 4-4). Most of the certified companies either have 20 employees or less (27%) or between 51 and 100 employees (24%). Most of the non-certified companies (70%) have up to 50 employees.

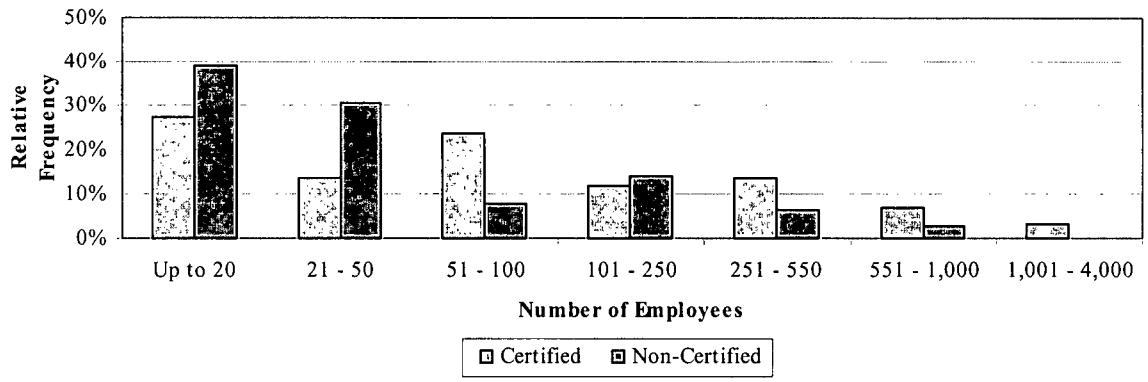

Figure 4-4: Number of employees of certified and non-certified companies.

Finally, respondents were asked to indicate the total number of product lines that their companies manufacture. The median number of product lines is 14.8. Results were separated into six classes and frequencies were calculated for each class (Figure 4-5). Forty-five percent of the companies have up to three product lines, and 22% have between four and six. Only 33% manufacture more than six product lines.

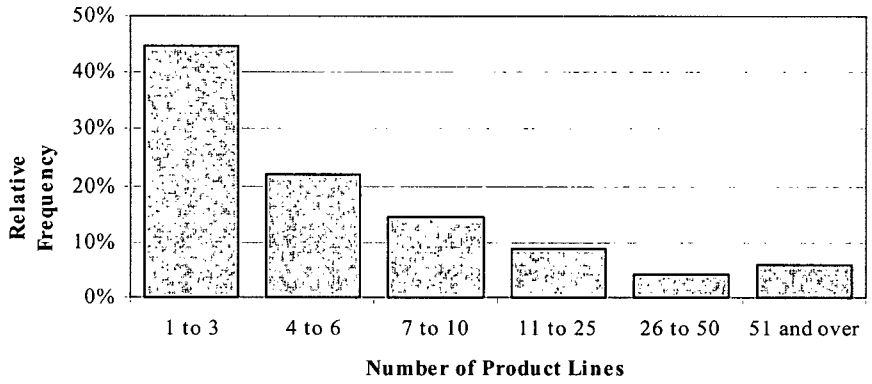

Figure 4-5: Total number of product lines in respondents' companies.

The number of product lines was also computed independently for certified and non-certified companies and separated into the same six classes as in Figure 4-5. Relative frequencies were computed and are shown in Figure 4-6. More than half (55%) of the non-certified companies have between one and three product lines. Thirty-two percent of the certified companies have between one and three product lines, and 25% have between four and six product lines. Only 26.4% of the certified companies and 12.0% of the non-certified companies have more than 11 product lines.

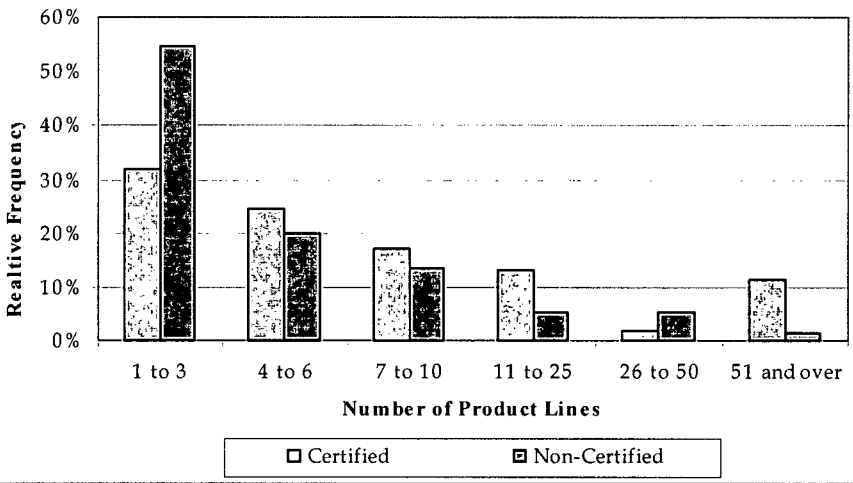

Figure 4-6: Number of product lines in certified and non-certified companies.

4.1.6. Chain of Custody Certification by Region

Respondents were asked to identify the location of their companies. Seventy-nine percent of the respondents were from the United States and 21% were from Canada. In order to better understand the regional effects, states and provinces were collapsed into four regions in the United States (West, Midwest, South, and Northeast) and three regions in Canada (Central, East/Maritimes, and West/North). Frequencies of responses of regions and countries were computed separately for certified and non-certified companies as well as for the entire sample (Table 4-5). In the United States, the majority of respondents (38) resided in the West, which was the only region where the number of certified companies was greater than the number of non-certified companies. The South region had the lowest number (18) of respondents as well as the lowest number of certified respondents (3). The majority of respondents (17) from Canada were from the West/North region. The Central and West/North regions had more non-certified companies than certified companies. In the East/Maritimes region, there was an equal number of certified and non-certified companies (3).

Table 4-5: Location of respondents from the United States and Canada.

	Total	Certified	Non-Certified
United States	110	49	61
West (AK, AZ, CA, CO, HI, ID, MO, NM, NV, OR, UT, WY, WA)	38	22	16
Midwest (IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI)	24	12	12
South (AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, TX, VA, WV)	18	3	15
Northeast (CT, MA,ME, NH, NJ, NY, PA, RI, VT)	30	12	18
Complete Responses Missing	18		
Non-Complete Responses	78		
Canada	29	11	18
Central (MB, ON, SK)	6	1	5
East / Maritimes (NB, NF, NS, PEI, QC)	6	3	3
West / North (AB, BC, NT, YT)	17	7	10
Complete Responses Missing	1		
Non-Complete Responses	0		

4.1.7. Non-Certified Companies

Nine of the questions in the survey were directed only to companies that were not chain of custody certified. Results are separated into two categories below: (1) questions directed only to those companies that intend on becoming chain of custody certified within the next five years; and (2) questions designed for all non-certified companies.

4.1.7.1. Companies Planning on becoming Chain of Custody Certified

Five questions were asked of those 19% of non-certified respondents that intend on becoming chain of custody certified within the next five years. Respondents were presented with ten options of certification bodies and asked which ones would likely be used in chain of custody certification. Relative frequencies were computed for each response category (Figure 4-7). The Sustainable Forestry Initiative (SFI) was the preferred certification body, with 34% of responses[3]. The SmartWood Program (SW) of the Rainforest Alliance was second with 25% of the responses. The Canadian Standards Association, the SGS Qualifor program, and the "other" category were the third choices of respondents, with 8% of the responses each (the most common responses in the "other" category were "ISO 14000" and "the least expensive").

[3] SFI had not launched its on-product label by the time this survey was designed. However, it was under development and could have been a valid response for companies planing on becoming chain of custody certified within the next five years.

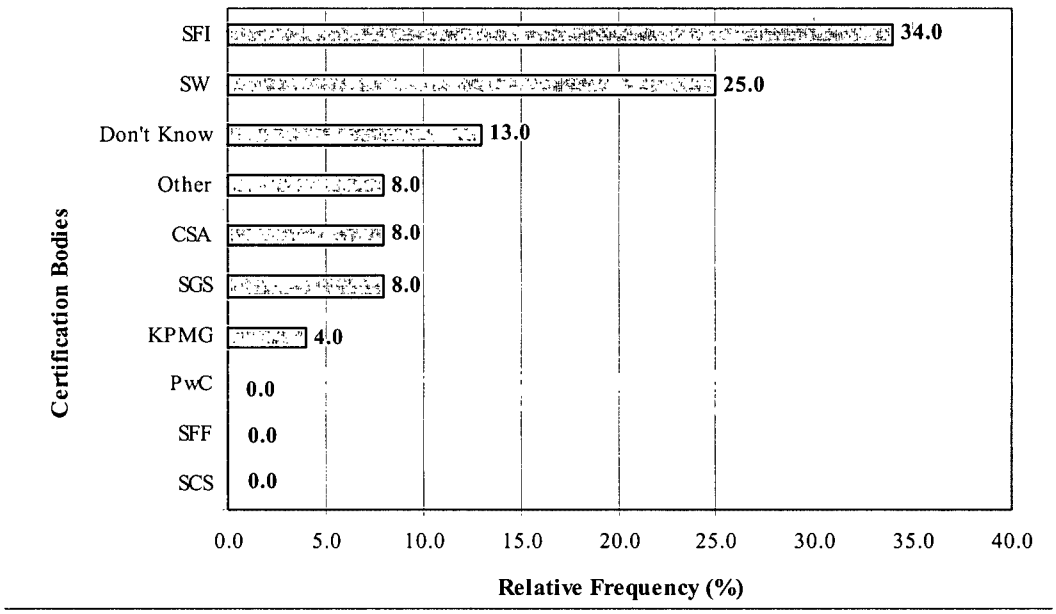

Figure 4-7: Preferences for certification bodies of non-certified companies.

Respondents were asked to rate their level of knowledge on five steps of chain of custody certification. A four-point scale varying from "1 = not at all knowledgeable" to "4 = very knowledgeable" was used. Means and standard deviations (SD) were computed for each response and are summarized in Figure 4-8. A one-way ANOVA test (alpha level of 0.05) was conducted in order to find out whether the means of the five chain of custody steps were significantly different from each other. The test supports the claim that there is no significant difference between the means (Table 4-6).

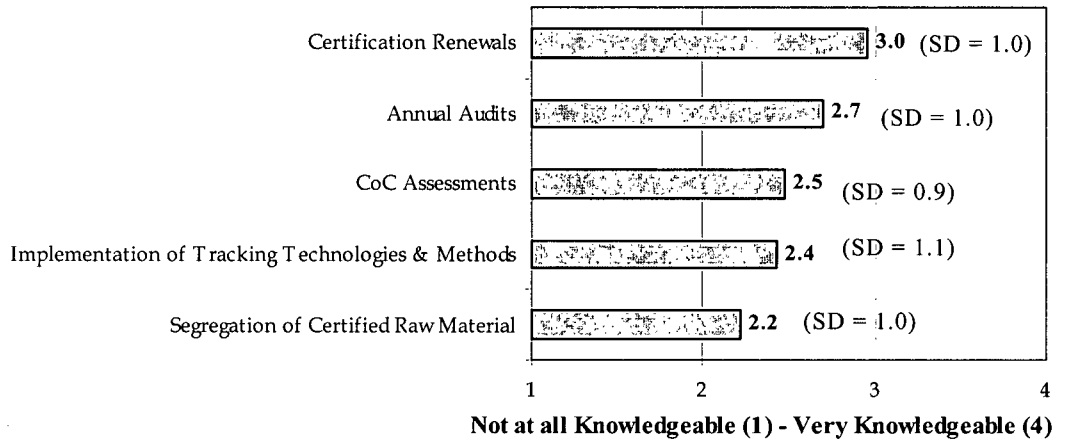

Figure 4-8: Non-certified companies levels of knowledge on chain of custody certification.

Table 4-6: One-way ANOVA for means of level of knowledge.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	7.252	4	1.813	1.862	0.122	2.454
Within Groups	107.130	110	0.974			
Total	114.383	114				

Respondents planning on becoming certified were also asked about their expectations regarding the costs of chain of custody certification. First, respondents were asked to give examples of product lines in their companies and then choose the most appropriate product line for answering the question. Responses were tallied and classified into three groups: lumber, other primary, and value-added products. Table 4-7 presents details on the products comprising each group.

Table 4-7: Types of product lines used to answer question on expect costs of chain of custody certification.

Group 1 Lumber	Group 2 Other Primary	Group 3 Value-Added
softwood lumber	timbers	pallets
hardwood lumber	veneers	furniture
	veneer logs	kitchen cabinet doors
	bark mulch	lock-wired florist pick
	sawdust	wood turnings
	logs	
	studs	
	wood chips	
	plywood	
	LVL	
	industrial panels	

Respondents were also asked about their expectations regarding costs of three phases of chain of custody certification for a typical product line: implementation (i.e. making the necessary changes), auditing, and maintenance (i.e. annual audits and renewals). Six categories of cost ranges (in US dollars) were presented for each one of the three phases. The summaries of the responses are seen in Figures 4-9, 4-10, and 4-11.

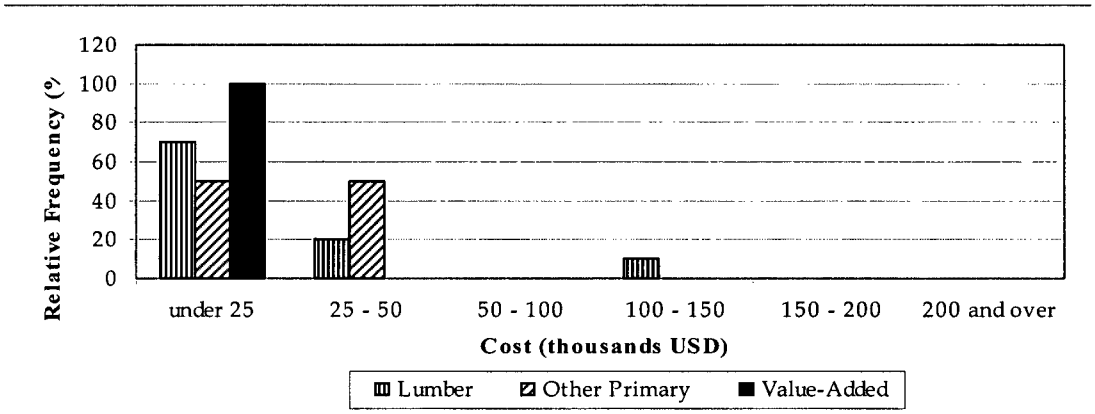

Figure 4-9: Expected costs of implementing chain of custody certification.

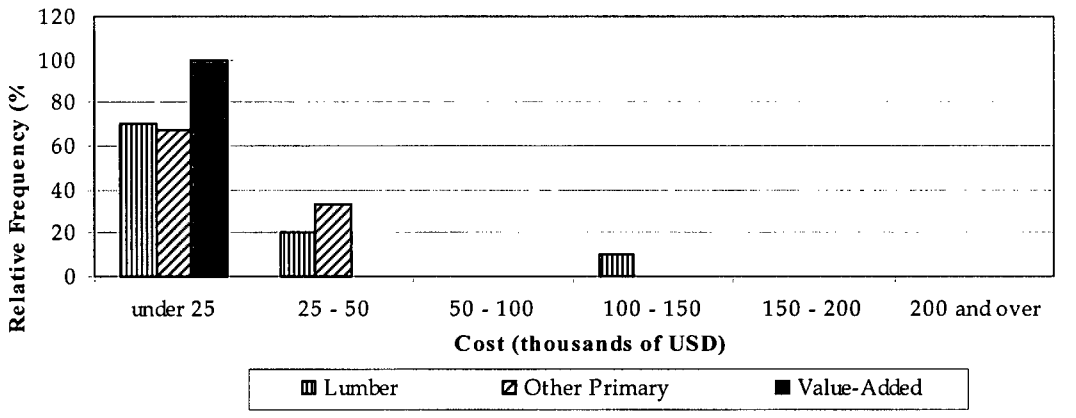

Figure 4-10: Expected costs of auditing chain of custody.

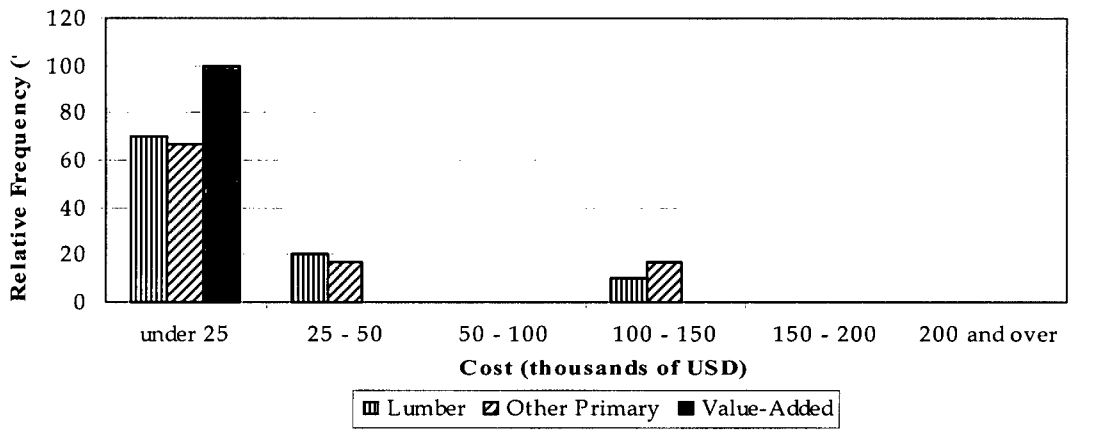

Figure 4-11: Expected costs of maintaining chain of custody certification.

The majority of the respondents using lumber (70%) and all respondents using value-added product lines to answer this question expect costs to be under US$25,000 for each one of the three phases of chain of custody (i.e. implementing, auditing, and maintaining). Only half of the respondents using a primary wood product line other than lumber expect the costs of implementing chain of custody certification to be under US$25,000. The other half expect it to be between US$50,000 and US$100,000. However, the majority of this group (67%) expect the costs of auditing and maintaining chain of custody certification to be under US$25,000.

Respondents were presented with five aspects of implementing chain of custody and asked to rank what they viewed as being the three most expensive aspects, with 1 being the most expensive[4]. Arbitrary scores of 3, 2, and 1 were assigned for ranks 1, 2, and 3, respectively. Based on this scoring system, evaluation points were computed and summarized in Figure 4-12. Chain of custody assessments were considered the most expensive factor with 30 points. However, the three factors clustered together not far behind: implementation of new technologies and methods (28), maintenance of chain of custody (27), and segregation of raw material (26). These close scores make it difficult to tell whether there is a difference between the first four responses.

[4] Statistical analyses cannot be carried out for this data due to the arbitrary nature of the scale.

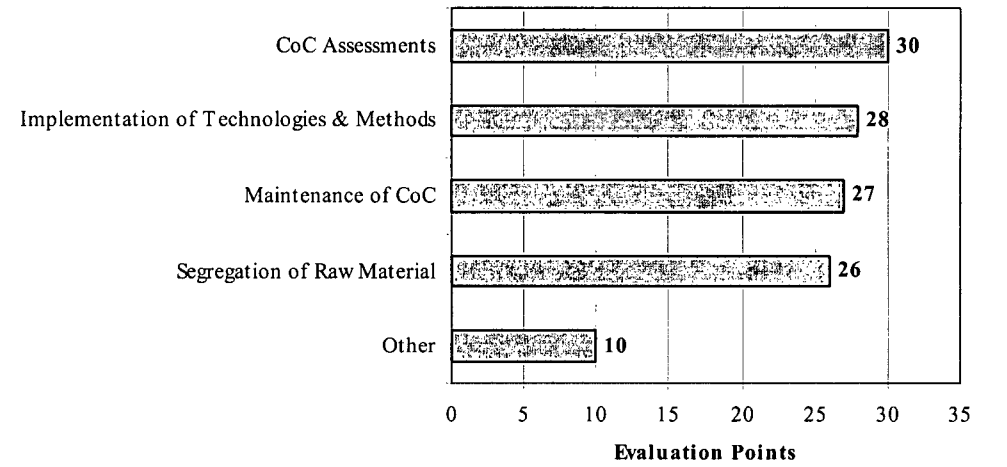

Figure 4-12: Expectations of highest costs for chain of custody certification.

4.1.7.2. Expectations of Non-Certified Companies

Four questions regarding respondents' expectations of the benefits, potential customers, and uses of certified wood products were directed at all non-certified companies identified in the survey. In all four questions, respondents were asked to assume that they would become chain of custody certified within the next five years.

First, respondents were asked to estimate the proportion of raw material that would come from non-certified source in the case that they were to become chain of custody certified. The mean was computed revealing that, on average, 59% of the raw material would come from non-certified sources.

A list of seven types of customers was presented to respondents and they were asked to choose the ones that they considered to be potential customers for certified products. Relative frequencies were calculated and the results are summarized in Figure 4-13. Twenty-four percent of the respondents expected that industrial customers would be potential customers for certified products, while 23% expected wholesalers to be potential customers.

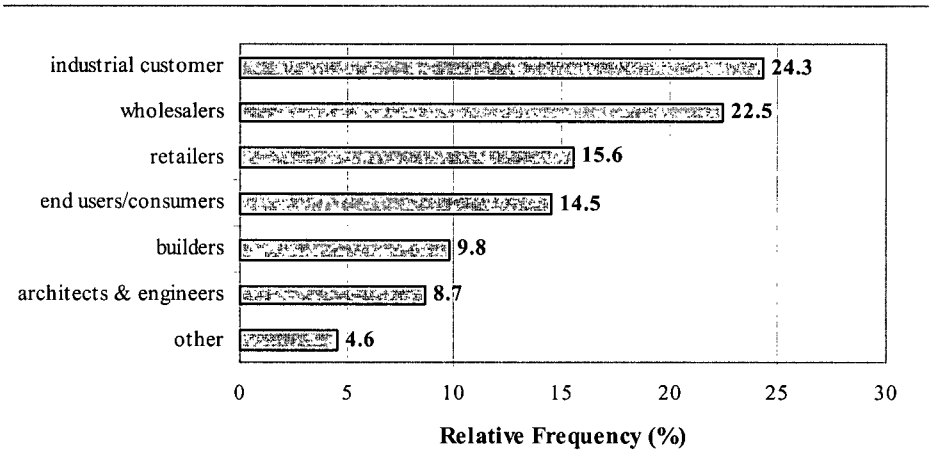

Figure 4-13: Expected customers of certified products.

A list of thirteen benefits was presented and respondents were asked to state whether they agreed or disagreed that chain of custody certification would help their companies to achieve those benefits. Specifically, they were asked to choose from a five-point Likert scale varying from "1 = strongly agree" to "5 = strongly disagree". Means and standard deviations were computed for each statement and results are summarized in Figure 4-14. Ninety-five percent confidence intervals were also computed for the means of each statement and the means of each statement were then tested against a neutral point (Table 4-8). This traditional hypothesis test verified if responses were significantly different from "3" (alpha level of 0.05), the point on the scale that represents an undecided or neutral attitude. Only four statements were not significantly different from "3": "better communication with customers (3.2)"; "better communication with social groups (3.1)"; "reduced pressure from Non-Governmental Organizations (NGOs) (3.1)"; and "better public relations (3.0)".

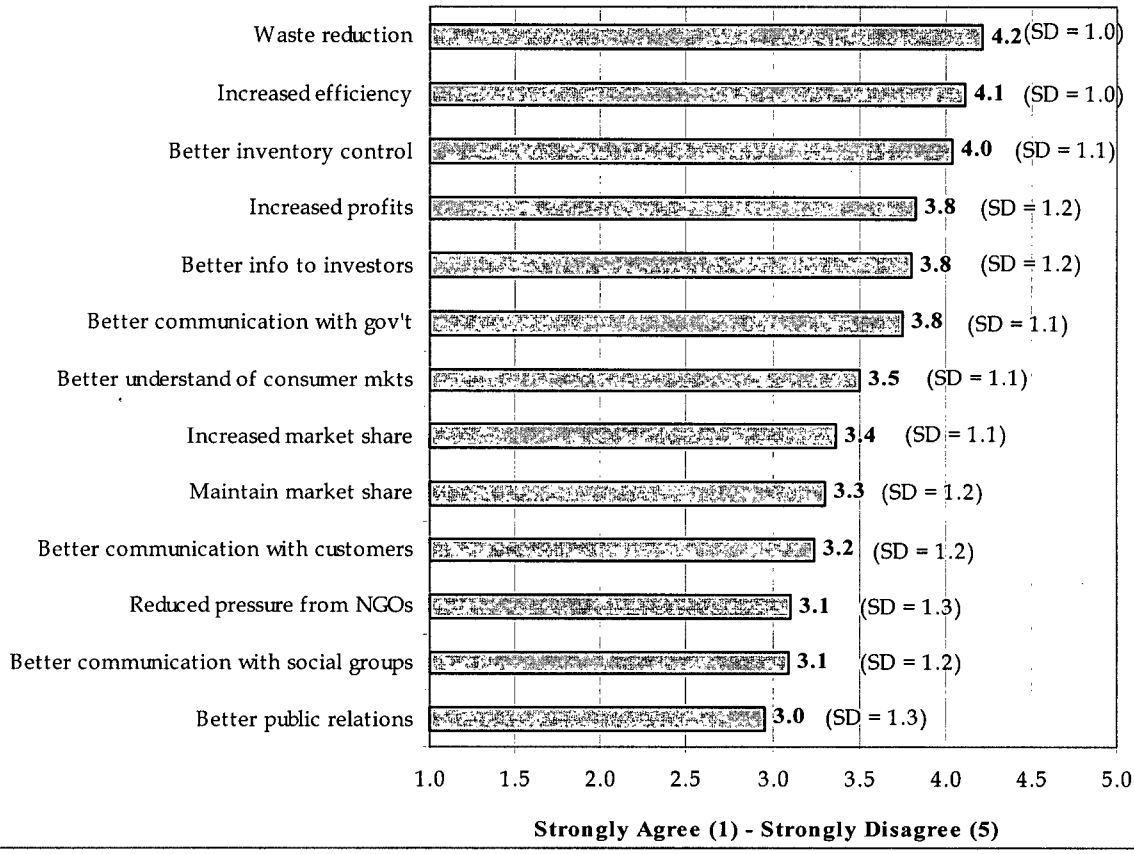

Figure 4-14: Attitudes of non-certified companies towards the potential benefits that chain of custody certification could provide.

Table 4-8: 95% confidence intervals of non-certified companies attitudes about the benefits of chain of custody certification.

	95% Confidence Interval
Waste reduction	4.2 ± 0.21*
Increased overall efficiency	4.1 ± 0.22*
Better inventory control	4.0 ± 0.24*
Increased profits	3.8 ± 0.25*
Better information to investors	3.8 ± 0.25*
Better communication with the government	3.8 ± 0.24*
Better understanding of consumer markets	3.5 ± 0.23*
Increased market share	3.4 ± 0.24*
Maintain market share	3.3 ± 0.25*
Better communication with customers	3.2 ± 0.24
Reduced pressure from environmental organizations	3.1 ± 0.27
Better communication with social groups	3.1 ± 0.24
Better public relations	3.0 ± 0.26

* Significantly different from a neutral point of 3 ($\alpha = 0.05$)

Lastly, an open-ended question was posed asking respondents to identify any other benefits from chain of custody certification that were not listed in the previous question. Responses were tallied and categorized into three types of responses. A group of respondents (46%) declared that they thought that chain of custody would bring no benefits at all for primary wood products companies. Another group (31%) of respondents believed that chain of custody certification could bring some benefits to certified companies like price premiums, increased competitive advantage, and increased profit margins. The third group (23%) mainly stated that they do not agree with the idea of chain of custody certification. Detailed responses are presented in Appendix IV.

4.1.7.3. Reasons for Not becoming Certified

Companies that do not intend on becoming chain of custody certified were asked to rank the three most important reasons for this decision, with 1 being the most important. Arbitrary scores of 3, 2, and 1 were assigned to ranks of 1, 2, and 3, respectively, and evaluation points were computed for each statement. By far, the most important reason (164 points) for not becoming certified is the fact that respondents believe that chain of custody certification would not bring any benefits to their companies. Lack of incentive from the government had little importance, on average (82 points). The other five reasons had similar levels of importance to respondents, with points ranging from 104 to 123 (Figure 4-15).

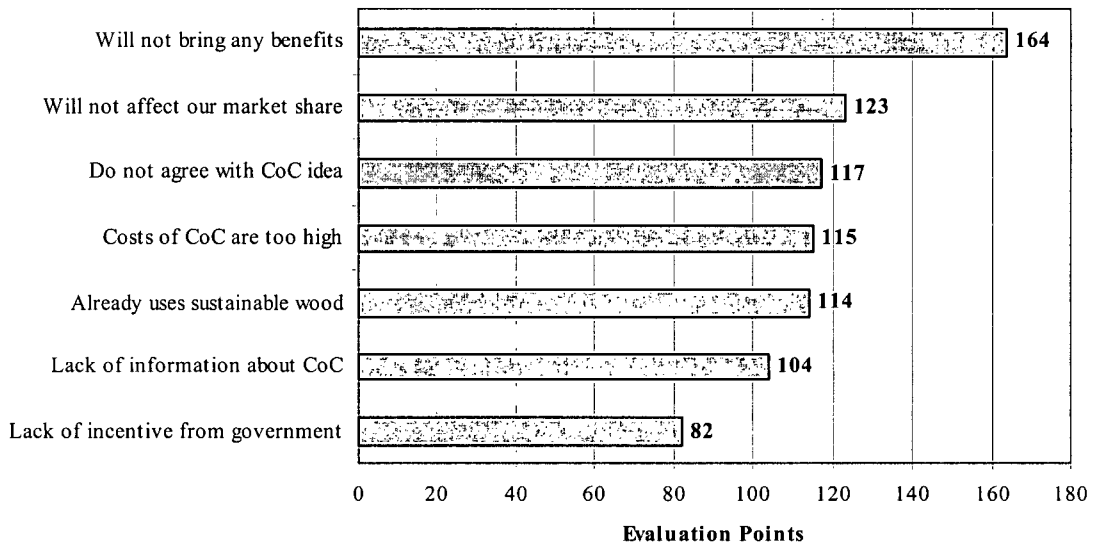

Figure 4-15: Reasons for not becoming chain of custody certified.

4.1.8. Certified Companies

Thirty-nine percent of the 158 companies that completed the survey were chain of custody certified. These companies were asked to answer two sections (Sections 2 and 3) of the questionnaire specifically designed for certified companies.

First, respondents were asked to specify which accredited certification body or bodies certified their companies. Relative frequencies were computed for each certification body and are seen in Figure 4-16. The majority of respondents (60%) were certified by the SmartWood Program (SW) of the Rainforest Alliance. Scientific Certification Systems (SCS) certified 26% of the respondents. The "other" category comprised 9% of the responses, the most common of which was the "Sustainable Forestry Initiative (SFI)"[5].

[5] SFI was still developing an on-product label and had not launched it by the time this survey was conducted. Therefore, SFI was not included as an option for certified companies.

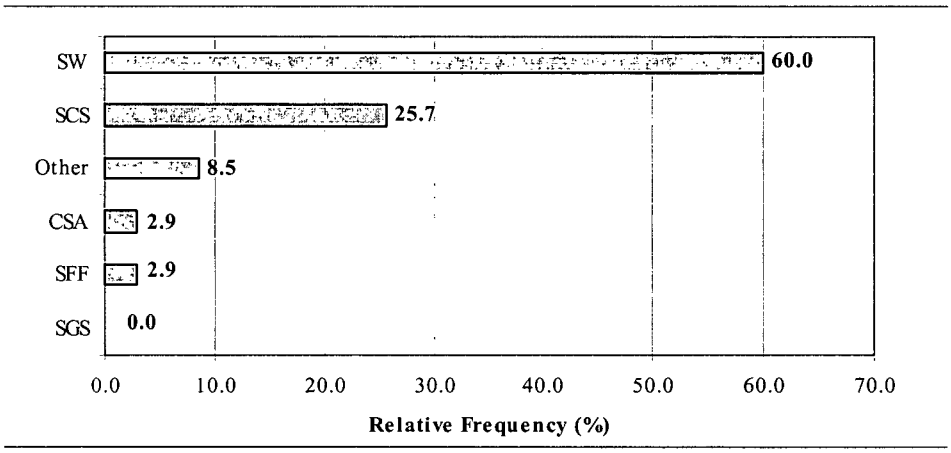

Figure 4-16: Accredited certification bodies used for chain of custody certification.

Certified respondents were also asked to identify the customers for their companies' certified products. Relative frequencies (Figure 4-17) show that 22% of the respondents stated that "industrial customers" purchase their certified products. "Retailers" and "wholesalers" each accounted for 20% of the responses.

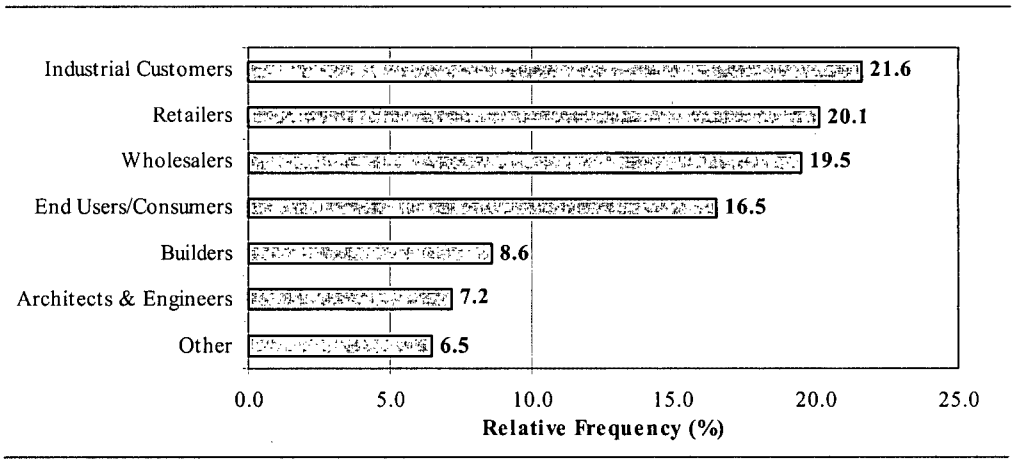

Figure 4-17: Customers for chain of custody certified products.

4.1.8.1. Product Lines of Certified Companies

Respondents were asked to present information on their companies' certified and non-certified product lines. Specifically, they were asked to list up to four of their most common wood product lines. Next, they were asked to provide information on 2001 sales revenues for each of the product lines, whether or not it was certified, as well as the proportion of certified

raw materials used in each product line. Responses on types of product lines were tallied and divided into three groups: lumber, other primary, and value-added wood products. Group membership is seen in Table 4-9.

Table 4-9: Groups of product lines.

Lumber	Other Primary	Value-Added
hardwood lumber	veneer	moulding
softwood lumber	logs	sidings
	timbers	decking
	structural beams	flooring
	plywood	stair parts
	studs	flooring
	panelling	fencing
	chips	garden gazebos
	sawdust	pallet stock
	MDF	fixtures
		shingles

For each product line, Table 4-10 summarizes median sales revenues, relative frequencies of the certification status, and average proportions of certified raw material used. The median was used for sales revenues due to the presence of outliers. Lumber was the most frequent (40.6%) type of product line listed. Although respondents were asked to list only the primary wood product lines, value-added product lines accounted for 34.7% of the responses. This may indicate that the words "primary wood product line(s)" should have been better defined in the question. At US$5 million, the approximate sales revenues of "lumber" and "other primary" product lines were the same. The highest proportion of certified product lines (22.0%) was seen in "lumber", followed by "value-added" (13.6%). Although "other primary" wood products had the lowest average proportion of certified product lines, this group had the highest proportion (67.6%) of certified raw material used.

Table 4-10: Information on the product lines of certified companies (n = 48).

Group	Relative Frequency	Sales Revenue in 2001 (Median in USD)	Status		% Certified Raw Material
			Certified	Non-Certified	
Lumber	41.5%	$5,000,000	22.0%	78.0%	40.8%
Other Primary	25.5%	$7,500,000	11.1%	89.9%	67.6%
Value-Added	33.0%	$6,000,000	15.8%	84.2%	36.0%

4.1.8.2. Certified Raw Materials

Respondents were asked to identify the types of wood that they used in their certified products: softwoods, hardwoods, tropical hardwoods, or other. Relative frequencies were calculated for each type of wood and results are summarized in Figure 4-18. Forty-four percent of the respondents stated that they use non-tropical hardwoods in their certified products, while 42% use softwoods. Only 11% use tropical hardwoods.

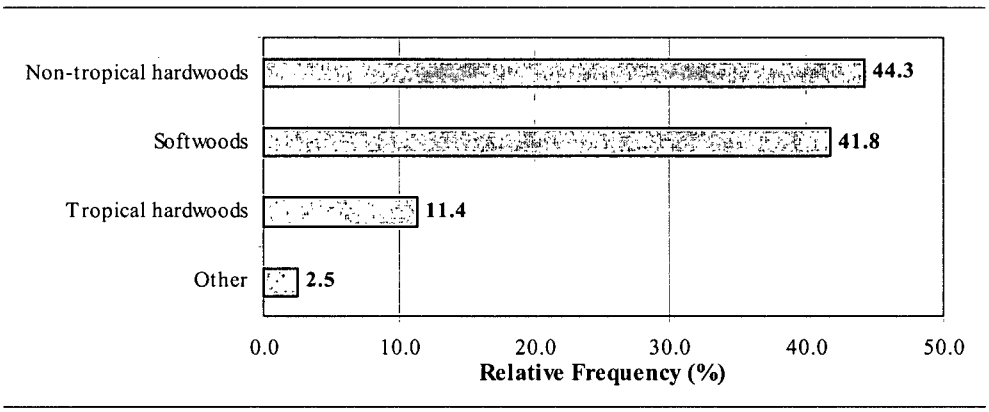

Figure 4-18: Types of wood used in certified products.

Respondents were also asked to indicate whether their companies supplied all of their logs. Relative frequencies were computed and are presented in Table 4-11. Approximately 85% of the respondents stated that they do not supply all of their logs. These respondents were asked to indicate the number of log suppliers that their companies used and how many of these supplied certified logs. The mean was computed for both answers. On average, respondents use a total of 82.8 log suppliers, and an average of 9.7 of these supply certified logs.

Table 4-11: Supply of raw materials for chain of custody certified companies.

Supply All of Its Logs?	Frequency	%
No	50	84.7%
Yes	9	15.3%
Total	59	100.0%

4.1.8.3. Chain of Custody Methods and Technologies

A list of technologies was provided and respondents were asked to identify which ones their companies used to track materials for chain of custody. Relative frequencies were computed and are summarized in Figure 4-19. Paint daubs and labels were the two most commonly used techniques with 30.3% and 29.3% of the responses, respectively. Barcode labels and "other" were the third (16.2%) and fourth (14.2%) most frequent answers, respectively. The "other" category included computer stamps, loading and delivery slips, trip/scale tickets, and material segregation. Hammermarks (8%), latshbacker tags (2%), touch memories (0%), and radio frequency (0%) are not as commonly used.

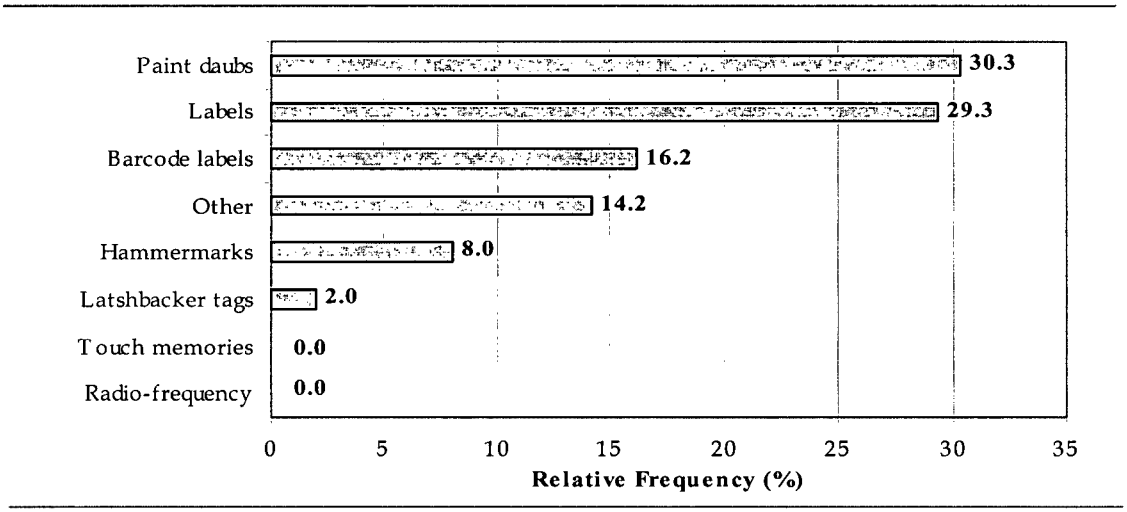

Figure 4-19: Technologies used to identify material source.

4.1.8.4. Costs of Chain of Custody Certification

Respondents were asked about the costs of implementing (i.e. making the necessary changes), auditing, and maintaining (i.e. annual audits and renewal) chain of custody certification for a typical product line in their company. First, respondents were asked to specify which product line they were using to answer the question. Responses were then tallied and separated into three groups: lumber, other primary, and value-added. The types of product lines included in each group are seen in Table 4-12.

Table 4-12: Groups of product lines used to specify the costs of chain of custody certification.

Lumber	Other Primary	Value-Added
Softwood lumber	veneer	shingles
Hardwood lumber	plywood	moldings
	panelling	decking
	timbers	stair parts
	chips	flooring
	logs	furniture
		wood handle
		fencing

Six cost ranges were listed for each phase of chain of custody certification (implementation, audition, and maintenance) and respondents were asked to choose the most appropriate response for each stage. A summary of the relative frequencies is presented in Figures 4-20, 4-21, and 4-22. The majority of respondents (from 85% to 95%) from all three groups of product lines stated that the costs of implementing, auditing, and maintaining chain of custody certification for a product line in their company was under US$25,000 for each activity.

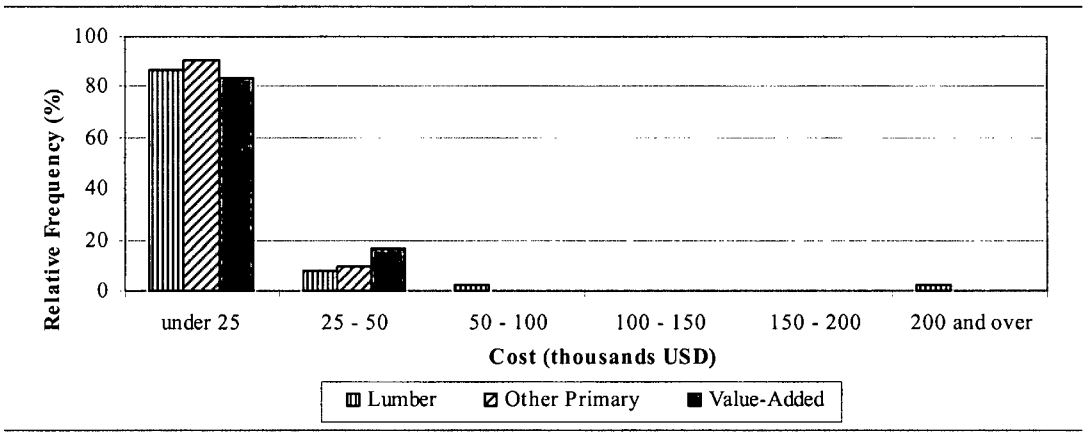

Figure 4-20: Costs of implementing chain of custody.

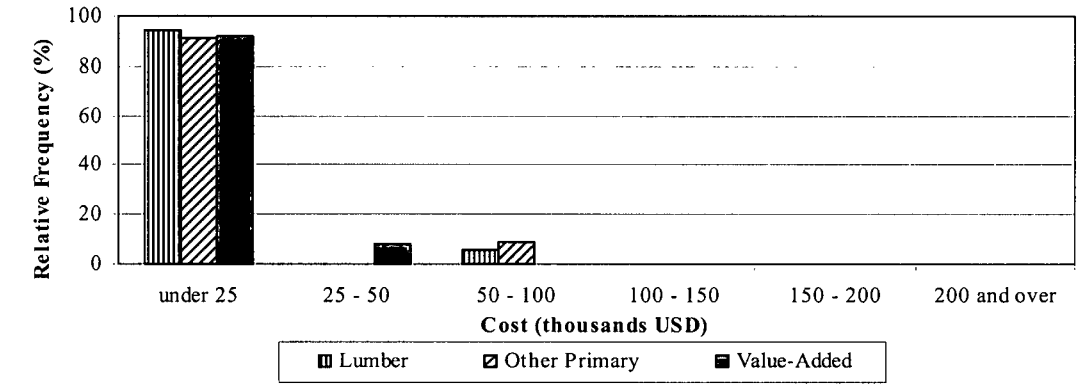

Figure 4-21: Costs of auditing chain of custody.

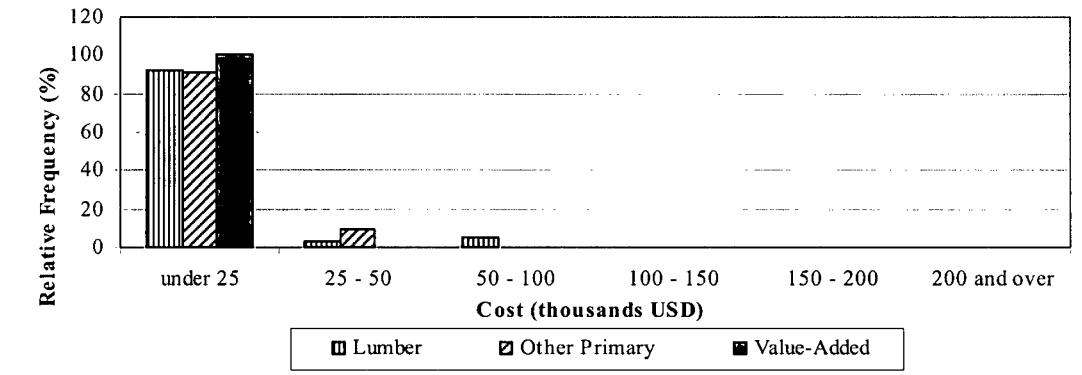

Figure 4-22: Costs of maintaining chain of custody certification.

4.1.8.5. Difficulties of Chain of Custody Certification

Respondents from the certified companies were asked to rank the three greatest difficulties (1 being the most difficult issue) that their companies faced when implementing chain of custody certification. Arbitrary scores of 3, 2, and 1 were assigned to ranks of 1, 2, and 3, respectively and evaluation points were computed for each category (Figure 4-23). By far, "insufficient supply of certified wood" was ranked the greatest difficulty when implementing chain of custody certification with 126 points. "Material segregation" (55 points), "employees' training" (52 points), and "high costs" (50 points) were each very close and therefore, all three can be equally considered to be the second most difficult issues when implementing chain of

custody. "Lack of information about the process" was the third most difficult factor, with 41 points, followed lastly by "other" factors and "lack of government collaboration".

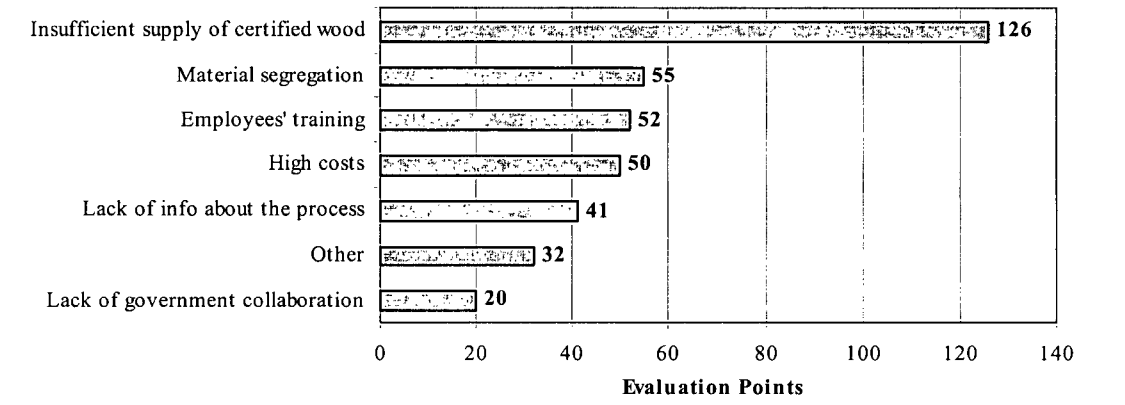

Figure 4-23: Most difficult factors in implementing chain of custody certification.

4.1.8.6. Benefits Resulting from Chain of Custody Certification

A list of thirteen statements regarding possible benefits obtained by chain of custody certification was presented. Respondents were asked to specify whether they agreed or disagreed with each statement, selecting responses from a five-point Likert scale varying from "1 = strongly agree" to "5 = strongly disagree". Means and standard deviations were computed for each statement and are summarized in Figure 4-24. Ninety-five percent confidence intervals were also computed for each statement and means of each statement were tested against a neutral point (Table 4-13). This hypothesis test verified if responses were significantly different from "3" (alpha level of 0.05), which is the point in the scale that represents an undecided or neutral attitude. Five statements did not have means significantly different from "3". They indicated that respondents, on average, neither agree nor disagree that chain of custody certification is providing their companies with "increased market share", "maintenance of market share", "better communication with customers", "reduced pressure from NGOs", and "better public relations".

Respondents disagree with all other statements including "better understanding of consumer markets", "better communication with social groups", "better information to investors", increased profits", "better inventory control", "increased overall efficiency", "waste reduction", and "better communication with the government".

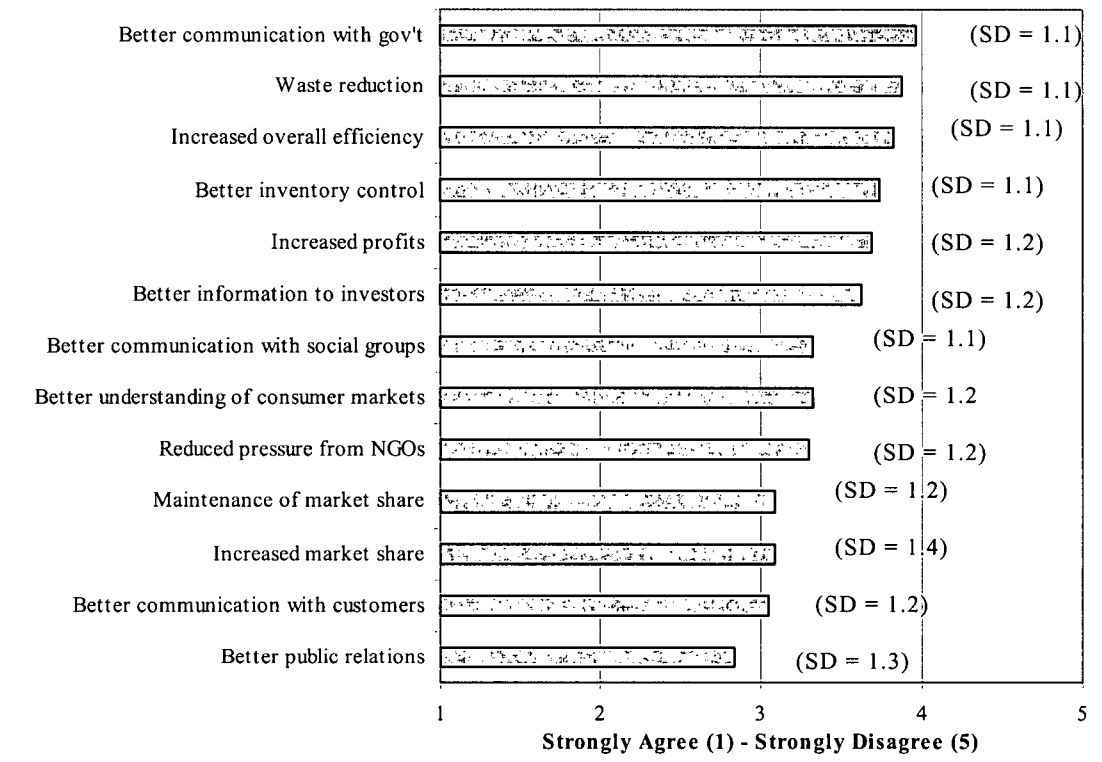

Figure 4-24: Attitudes of certified companies regarding benefits derived from chain of custody certification.

Table 4-13: 95% confidence intervals of average agreement levels.

	95% Confidence Interval
Better communication with the government	4.0 ± 0.28*
Waste reduction	3.9 ± 0.27*
Increased overall efficiency	3.8 ± 0.29*
Better inventory control	3.7 ± 0.28*
Increased profits	3.7 ± 0.30*
Better information to investors	3.6 ± 0.31*
Better communication with social groups	3.3 ± 0.29*
Better understanding of consumer markets	3.3 ± 0.30*
Reduced pressure from environmental organizations	3.3 ± 0.31
Maintain market share	3.1 ± 0.32
Increased market share	3.1 ± 0.35
Better communication with customers	3.1 ± 0.29
Better public relations	2.8 ± 0.33

* Significantly different from a neutral point of 3 ($\alpha = 0.05$).

Respondents were also presented with an open-ended question as a means of identifying any other benefits that were derived from chain of custody certification that had not been listed previously (details in Appendix IV). Responses were tallied and six groups were identified (Table 4-14). Approximately 47% of the respondents stated that they have not observed any benefits from chain of custody certification thus far. They explained that this fact might be a consequence of underdeveloped markets, a lack of supply of certified products, and non-existent demand for certified products. "Other benefits" was the second most frequent response with 17% of responses. This varied group included propaganda, increased efficiencies, personal satisfaction, strengthened relationships with suppliers, and enhanced sustainable forest management.

Table 4-14: Other benefits derived from chain of custody certification.

	Relative Frequency
Market access	13.3%
Employee morale/pride	6.7%
Competitive advantage	10.0%
Enhanced image with local environmental groups	6.7%
No benefits so far	46.7%
Other benefits	16.7%

4.1.9. Expected versus Actual Benefits of Chain of Custody Certification

The same question listing thirteen statements about benefits derived from chain of custody certification was asked of certified and non-certified companies. The results of both questions were plotted together in Figure 4-25 in order to compare the benefits that non-certified companies expect to obtain from chain of custody certification with the benefits that certified companies are obtaining in reality. A series of z-tests (alpha level of 0.05) were made for the means of certified and non-certified companies in each statement. The tests showed that there were no significant differences between the responses of certified and non-certified companies for all statements.

In general, the average of most of the responses was between "neither agree nor disagree" and "disagree". However, non-certified companies seemed to be somewhat more disagreeable in most of the statements. The only exceptions to this were for: "improved communication with the government", "improved communication with social groups", and "reduced pressure from non-governmental organizations".

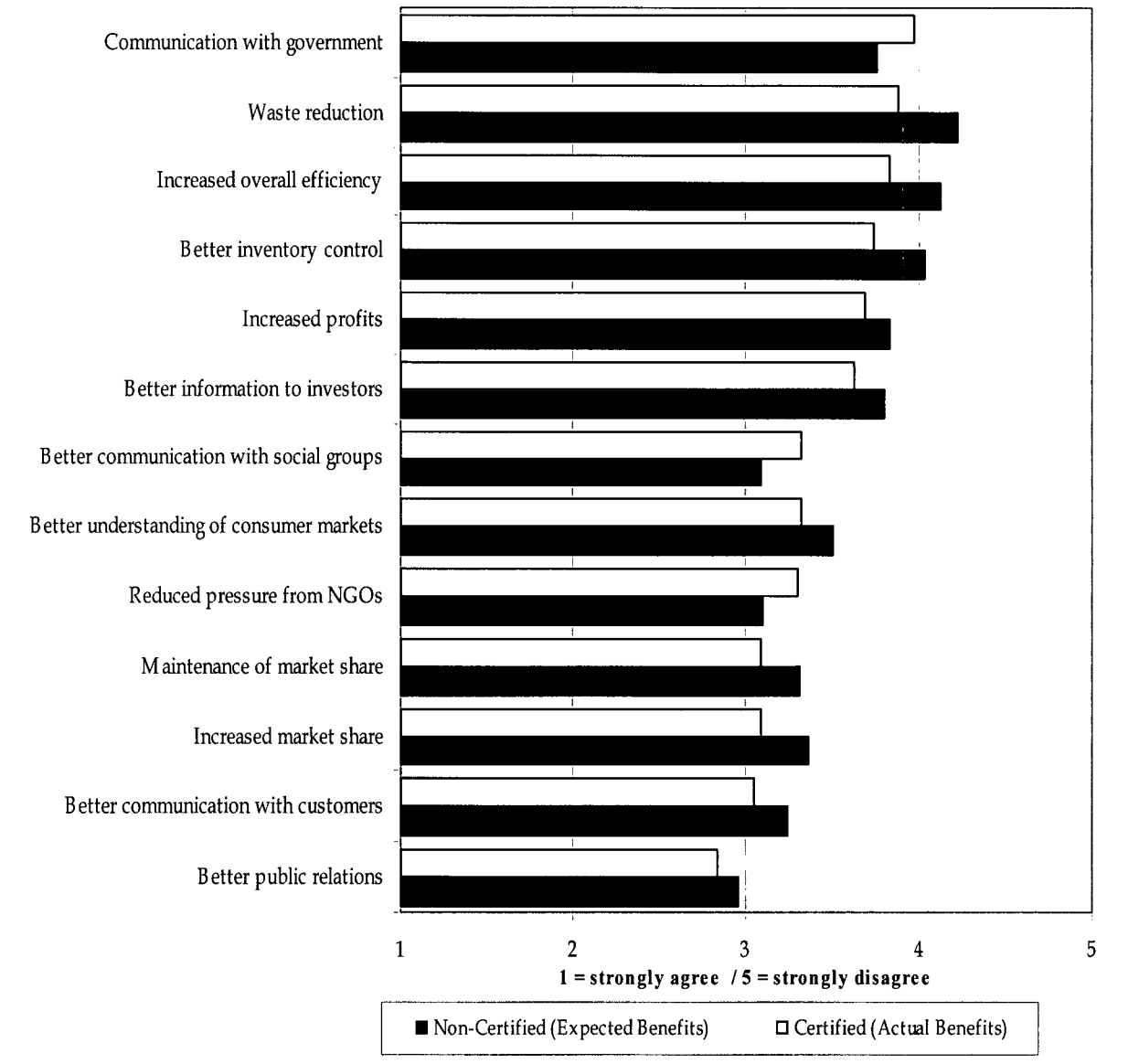

Figure 4-25: Expected versus perceived benefits from chain of custody certification.

4.1.10. Cluster Analysis of Actual and Expected Benefits of Chain of Custody Certification

Cluster analysis can be used to find natural underlying groupings of objects. In the case of this study, a cluster analysis was conducted in order to identify the types of companies that are most likely to derive benefits from chain of custody certification. Questions 9 (Section 1) and 2 (Section 3) were identical Likert scale questions asked in different sections in order to reach both types of respondents (certified and non-certified companies). The answers to these questions were merged, constituting the raw data for the analysis.

A partitioning or non-hierarchical technique was used to analyze this data. K-Means clustering is the partitioning technique offered by SPPS 10.0 for Windows and is a suitable technique for larger data sets like the one of this study (LeMay 2001). This technique requires the number of final clusters to be known and specified in advance. Solutions for two, three, and four clusters were considered and the three-cluster solution seemed the most appropriate one because it presented a clearer definition of clusters with more uniform results than the other two solutions.

The number of iterations that was required to achieve the final cluster centers was ten. Final cluster centers and the distances among them are presented in Tables 4-15 and 4-16, respectively. Means of the final cluster centers were computed for each cluster. The mean for Cluster 1 was 4.9 indicating that respondents classified in this cluster tend to "strongly disagree" that chain of custody certification is bringing or will bring any benefits to their companies. With a mean of 3.5, respondents from Cluster 2 tend to "neither agree nor disagree" with this point. Respondents from Cluster 3 are between "agree" and "neither agree nor disagree" with a mean of 2.6. Ninety-five percent confidence intervals were computed for each cluster center mean: Cluster 1 had a confidence interval of 4.9±0.2, Cluster 2 had one of 3.5±0.3, and Cluster 3 had one of 2.6±0.3.

Table 4-15: Final clusters centers.

	Cluster		
	1	2	3
Better inventory control	5	4	3
Waste reduction	5	4	3
Increased profitability	5	4	3
Increased market share	5	3	2
Maintenance of market share	5	3	2
Increased overall efficiency	5	4	3
Better information to investors	5	4	3
Better understanding of consumer markets	5	3	3
Enhanced communication with the government	5	4	3
Enhanced communication with customers	5	3	2
Enhanced communication with social groups	5	3	3
Reduced pressure from environmental organizations	5	3	2
Better public relations	4	3	2
Mean	4.9	3.5	2.6

Table 4-16: Distance between final cluster centers.

Cluster	1	2	3
1		4.9	7.7
2	4.9		3.3
3	7.7	3.3	

Characteristics of each cluster were identified in order to establish profiles of the clusters. Specifically, the proportion of certified and non-certified companies, average sales revenues, average numbers of employees, average numbers of product lines, and locations were computed for each cluster (Table 4-17). One-way ANOVA was used to verify if there were any significant differences (alpha level of 0.05) between the means of sales revenue, number of employees, and number of product lines for the three clusters. Results of the three one-way ANOVA tests showed that means for sales revenue, number of employees, and number of product lines are not significantly different for the three clusters (Tables 4-18, 4-19, and 4-20).

Table 4-17: Characteristics of the three clusters.

	Cluster 1 (n = 36)	Cluster 2 (n = 60)	Cluster 3 (n = 53)
Sales Revenue	$6,983,182	$15,580,161	$14,431,111
# Employees	38.8	57.0	50.5
# Product Lines	3.3	5.5	6.2
Certification Status			
Certified	38.9% *	28.3% *	52.8% *
Non-Certified	61.1%	71.7%	47.2%
Location			
USA	86.1% *	81.7% *	71.7% *
Canada	13.9%	18.3%	28.3%
Cluster Centers Means	4.9	3.5	2.6

* Significantly different from remaining two clusters ($\alpha = 0.05$).

Table 4-18: One-way ANOVA for average sales revenue of the three clusters.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	$1.1x10^{15}$	2	$5.7x10^{14}$	2.2372	0.1123	3.0912
Within Groups	$2.4x10^{16}$	96	$2.5x10^{14}$			
Total	$2.6x10^{16}$	98				

Table 4-19: One-way ANOVA for average number of employees of the three clusters.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	4,962.6	2	2,481.3	0.7482	0.4757	3.0820
Within Groups	351,553.0	106	3,316.5			
Total	356,515.6	108				

Table 4-20: One-way ANOVA for average number of product lines of the three clusters.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	136.2	2	68.2	2.7621	0.0678	3.0828
Within Groups	2,589.4	105	24.7			
Total	2,725.7	107				

Z-tests were used to compare the proportions of certified and non-certified companies. Three tests were necessary to verify if differences between the three clusters were significant. The Bonferroni adjustment procedure was used to adjust the alpha level of each individual test in order to ensure that the overall alpha level would remain 0.05. According to this correction, the alpha level for each one of the tests should be 0.017 (SISA 2002, Tabachnick and Fidell 2001). The same procedure was used to compare the proportion of companies from Canada and from the

United States in each cluster. The z-tests indicated that the proportion of certified and non-certified companies were significantly different (alpha level of 0.017) in the three clusters (Table 4-21). The proportion of companies in Canada and the United States was also significantly different (alpha level of 0.017) in the three clusters (Table 4-22).

Table 4-21: z-tests for proportion of certified companies in the three clusters.

	z-test	z critical	Alpha Level	Significant Difference
Cluster 1 x Cluster 2	-33.7	± 2.39	0.017	✓
Cluster 1 x Cluster 3	-12.0			✓
Cluster 2 x Cluster 3	-28.8			✓

Table 4-22: z-tests for proportion of US companies in the three clusters.

	z-test	z critical	Alpha Level	Significant Difference
Cluster 1 x Cluster 2	7.19	± 2.39	0.017	✓
Cluster 1 x Cluster 3	17.7			✓
Cluster 2 x Cluster 3	15.8			✓

Even though the means for sales revenue, number of employees, and number of product lines are not significantly different for the three clusters, a distinct trend is noted showing that companies from Clusters 2 and 3 tend to be larger. Cluster 3 was the only cluster that had a higher proportion of certified companies (52.8%) than of non-certified companies (47.2%). This cluster was also the most agreeable with respect to benefits derived from chain of custody certification (2.6) and is the cluster with the greatest proportion of Canadian companies (28.3%). Cluster 2 had the smallest proportion of certified companies (28.3%) and generally a neutral attitude regarding the benefits of chain of custody certification (3.5). Cluster 1 tended to contain smaller companies, the most disagreeable attitude about benefits of chain of custody, and the largest proportion of American companies (86.1%).

4.1.11. Discriminant Function Analysis of Certified and Non-Certified Companies

A discriminant function analysis was undertaken for certified and non-certified companies. This analysis was used in order to find out how chain of custody certified and non-certified companies differ based on sales revenues, numbers of employees, and numbers of product lines. The specification of classification functions to predict group membership was also an objective of the discriminant function analysis.

Discriminant function analysis "is highly sensitive to the inclusion of outliers" (Tabachnick and Fidell 2001). Therefore, the first step of this analysis consisted of identifying and removing outliers from the raw data. In order to accomplish this, data for the three discriminant variables were standardized. Values with z-scores of greater than 3.29 were eliminated (Tabachnick and Fidell 2001).

4.1.11.1. Assumptions

Discriminant function analysis is based on two assumptions. First, the within-group covariance matrix should be the same for all groups. Second, predictor variables should all be continuous and normally distributed (Manly 1994).

The assumption of equal within-group covariance matrices was verified using a Box's M test, which tests the null hypothesis of equal population covariance matrices. Results are summarized in Table 4-23. The test found a p-value of 0.000 (alpha level of 0.05), which indicates that the within-groups covariance matrices do not differ.

Table 4-23: Box' M test of equal within-group covariance matrices.

Box's M	41.564
F Approx.	6.672
df_1	6.000
df_2	48923.342
P-value	.000

Each predictor variable was tested for normality in order to verify the assumption of multivariate normality. Values of skewness and kurtosis were computed for each variable and are

summarized in Table 4-24. A normal distribution has values of skewness and kurtosis equal to zero. All three variables had values of skewness and kurtosis different from zero, each being positively skewed and having positive kurtosis. However, "discriminant function analysis is robust to failures of normality if violation is caused by skewness rather than outliers" (Tabachnick and Fidell 2001). Therefore, the fact that variables are skewed likely do not have any major effects on the results of this analysis.

Table 4-24: Kurtosis and skewness values for predictor variables.

	Kurtosis	Skewness
Sales Revenue	18.6	3.8
Number of Employees	5.7	2.4
Number of Product Lines	11.7	3.4

4.1.11.2. Important Discriminating Variables

One of the main objectives of this discriminant function analysis was to find out how certified and non-certified companies differ based on discriminant variables (sales revenue, number of employees, and number of product lines). It is possible to determine which discriminant variables were the most important in separating or discriminating between certified and non-certified companies. This procedure includes the use of discriminant loadings, which are the correlations between the canonical discriminant function and the three predictor variables (Dillon and Goldstein 1984). The higher the discriminant loading (absolute value), the greater the importance of the variable in discriminating the groups (Dillon and Goldstein 1984) (Table 4-25). The number of employees and number of product lines had relatively high loadings: 0.678 and 0.611, respectively. These two variables were the most important variables in discriminating between chain of custody certified and non-certified companies.

Table 4-25: Important discriminating variables.

Predictor Variables	Function 1
Number of Employees	0.678
Number of Product Lines	0.611
Sales Revenue	0.315

4.1.11.3. Classification Functions

One of the objectives of discriminant function analysis is to find classification functions that predict group membership (Tabachnick and Fidell 2001). The analysis yields one classification function for each group. Data for a new case are inserted into each classification function resulting in a classification score for each group. The new case is assigned to the group with the highest classification score (Tabachnick and Fidell 2001). Classification function coefficients for both groups are presented in Table 4-26. The Fisher's linear discriminant functions for the certified companies group (Z_1) and non-certified companies group (Z_2) are as follows:

$$Z_1 = -1.420 + (3.667\text{x}10^{-2})(X_1) + (5.932\text{x}10^{-3})(X_2) + (-7.998\text{x}10^{-10})(X_3) \quad \text{(Equation 1)}$$

$$Z_2 = -0.927 + (1.724\text{x}10^{-2})(X_1) + (1.648\text{x}10^{-3})(X_2) + (1.008\text{x}10^{-8})(X_3) \quad \text{(Equation 2)}$$

In order to determine which group a new company would belong to, the values of the discriminant variables for that company must be entered into the two equations. The equation yielding the highest result indicates the group membership for the new company.

Table 4-26: Classification function coefficients.

Variables		Groups	
		certified	non-certified
	Constant	-1.420	-.927
X_1	# of Product Lines	$3.667\text{x}10^{-2}$	$1.724\text{x}10^{-2}$
X_2	# of Employees	$5.932\text{x}10^{-3}$	$1.648\text{x}10^{-3}$
X_3	Sales Revenue	$-7.998\text{x}10^{-10}$	$1.008\text{x}10^{-8}$

4.1.11.4. Misclassification Error Rates

Cross validation was used to test how well the model constructed classifies the companies. This method consists of fitting the discriminating function using all but one observation, calculating the misclassification error rate, and repeating this procedure *n* times.

Table 4-27 presents detailed information on classification rates. Original grouped cases had a success rate of 63.4%, and 61.3% of the cross-validated cases were classified correctly. This indicates a fairly high degree of consistency of the classification model constructed (Tabachnick and Fidell 2001).

Table 4-27: Classification rates.

			Predicted Group Membership		Total
		Groups	non-certified	certified	
Original	Count	non-certified	43	10	53
		certified	24	16	40
	%	non-certified	81.1	18.9	100.0
		certified	60.0	40.0	100.0
Cross-validated	Count	non-certified	42	11	53
		certified	25	15	40
	%	non-certified	79.2	20.8	100.0
		certified	62.5	37.5	100.0

a. 63.4% of original grouped cases correctly classified.
b. 61.3% of cross-validated grouped cases correctly classified.

4.2. TELEPHONE SURVEYS

4.2.1. Response Rate and Adoption Levels

In addition to the mail questionnaire, a telephone survey of certification organizations was also implemented (Appendix II). An attempt was made to reach all of the organizations involved in certification. Five of the eight certification organizations contacted agreed to participate in this study, which represents a 62.5% response rate. Respondents were asked whether their organizations conduct chain of custody assessments. Four of the five organizations stated that they do (Table 4-28). The organization that does not perform chain of custody assessments explained that they were not planning to do so within the next five years. Only the respondents that were accredited to conduct chain of custody assessments answered the remaining questions.

Table 4-28: Chain of custody accreditation status of certification organizations.

	Yes	No	Total
Does CoC assessments?	4	1	5
If not CoC accredited - planning to?	0	1	1

All of the institutions that conduct chain of custody assessments are accredited by the Forest Stewardship Council (FSC). Therefore, it is important to bear in mind that results of these interviews represent the FSC approach to chain of custody certification. These institutions were asked to identify the number of primary wood products companies in North America that were chain of custody certified by them. The mean was computed and, on average, certification institutions have certified 60.5 primary wood products companies for chain of custody. Responses ranged from 2 to 160 companies.

When asked if there were any companies in the process of becoming certified, all four institutions said *yes*. The mean was computed and, on average, there are eight companies in the process of becoming certified. Responses varied from two to 18 companies.

4.2.2. Costs of Chain of Custody Certification

The second section of the survey collected information on the costs of chain of custody certification for primary wood products companies. First, respondents were asked if their institutions had some kind of unit for measuring the costs of chain of custody certification. One respondent said *yes*, but declared that the information was confidential.

Respondents were then asked to specify how their institutions determined the price charged for chain of custody assessments, annual audits, and renewals. Responses were tallied (Table 4-29) for five factors which were used in determining the costs of chain of custody: company location, size of the company, number of manufacturing facilities, complexity of the manufacturing process, and annual sales revenue.

Table 4-29: Parameters used to determine the price of chain of custody certification.

Parameter	Frequency
Company location	2
Size of the company	3
Complexity of manufacturing process	2
Annual sales revenue	1
Number of manufacturing facilities	2
Total	10

Respondents were asked about the range of the costs for each phase in the chain of custody process: assessments, annual audits, and certification renewals. Means were computed for each range of costs. According to the certification organizations, chain of custody assessments have costs varying from US$2,727.50 to US$5,093.75. Annual audits have costs varying from US$935.75 to US$1,630.00. Finally, costs of certification renewals every five years range from US$1,350.00 to US$2,260.00. However, it is important to note that there was a great deal of variation in defining the ranges. For example, the average lower range of chain of custody assessments was US$2,727.50, but the values used to calculate this average varied from US$315 to US$4,000. The variation within each lower and upper range is summarized in Table 4-30[6].

Table 4-30: Lowest and the highest values of each range of costs of chain of custody certification.

	Lowest Value			Highest Value		
	Minimum	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**
CoC Assessment	$315	$4,000	$2,727.50	$1,890	$17,000	$5,093.75
Annual Audits	$315	$1,440	$937.75	$630	$2,000	$1,630.00
Certification Renewal	$1,260	$1,440	$1,350.00	$2,000	$2,520	$2,260.00

The last question regarding costs of chain of custody certification asked respondents to estimate the annual indirect costs of implementing chain of custody for a forest products company. None of the respondents could give an exact or even an approximate value, but all of them stated that it depends on the size of the company. Large companies usually have some kind of quality management system (ISO 9000) in place that facilitates the implementation of chain of custody and lowers costs. Respondents also stated that large companies usually put more resources into marketing and promotional campaigns. Small companies usually have higher costs than large companies when implementing chain of custody. Respondents explained that this happens because small companies usually do not have quality management systems in place.

[6] Readers should be cautious when interpreting this information since it is not given in costs per unit and is, therefore, difficult to compare.

4.2.3. Benefits of chain of custody certification

Accredited certification institutions were asked about the benefits that companies may accrue from chain of custody certification. Respondents were asked to state whether they agreed or disagreed with five statements about benefits of chain of custody certification. Respondents chose their answers from a five-point Likert scale varying from "1 = strongly agree" to "5 = strongly disagree". These statements were adapted from Questions 9 (Section 1) and 2 (Section 3) of the written questionnaire designed for companies. Means of the answers were computed and are illustrated in Figure 4-26. Respondents tend to agree that chain of custody certification is helping companies to "increase their market share", to "maintain their market share", to "improve their communication with stakeholder groups", to "increase their profitability", and to have a "better inventory control".

Respondents were also asked to state any other benefits that they thought could result from chain of custody certification. Respondents stated that chain of custody certification:

- helps to connect links (in the supply chain);
- helps to maintain and promote the idea of certification;
- improves the environmental image of the company; and
- brings a sense of pride and prestige to the employees.

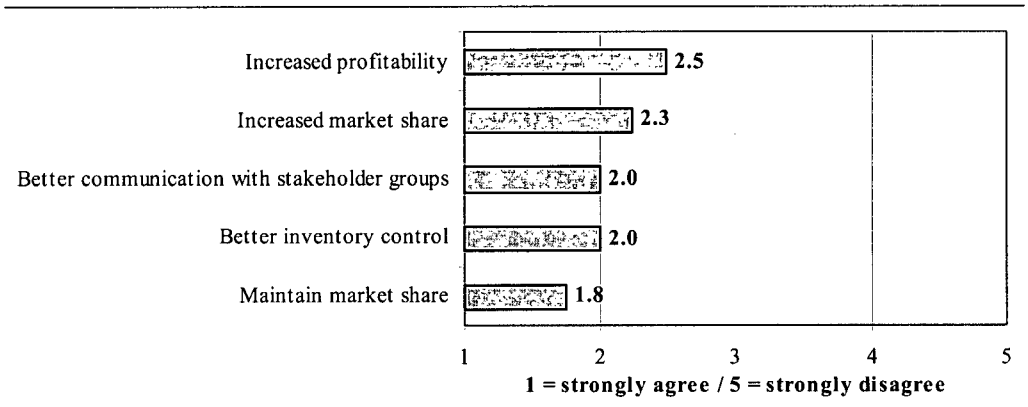

Figure 4-26: Benefits from chain of custody certification – certification bodies' perspective.

Respondents were then asked whether their institutions provide support beyond certification in assisting companies to acquire benefits from chain of custody. If they said *yes*, they were asked to specify the type of support. Three out of the four respondents said that they do provide some form of support in assisting companies to acquire benefits from chain of custody. All three of them stated that this support is provided in the form of special programs that provide assistance and clarification about chain of custody, like pre-audits, educational web sites, and subsidy programs to help small companies to become certified.

5. DISCUSSION

Primary wood products companies in Canada and the United States seem to have diverse expectations and perceptions about chain of custody certification. Some of the analyses revealed that the image companies have of chain of custody certification is probably related to factors such as company type, size, and even location.

Results from questionnaires mailed to companies were described in Chapter 4. They exhibit diverse information about different aspects of chain of custody certification such as adoption levels, types of certified product lines, customers of certified products, preferred certification bodies, and perceived and expected benefits and costs of chain of custody certification. This information will be useful in understanding key aspects of chain of custody certification and may help direct further research and development of this topic.

Information gathered by telephone interviews with certification bodies was very useful in complementing the information obtained from companies. It was especially important in understanding the costs of the process and how they relate to other aspects of chain of custody certification.

Information gathered in this study will be discussed within the context of the literature related to this topic and the objectives of this study:

1. To assess the current and expected adoption levels of chain of custody certification for the North American primary wood industry;
2. To assess the level of knowledge and perceived benefits and costs that non-certified companies have about chain of custody certification;
3. To examine benefits and costs certified companies obtained from the process and the technologies they use to track certified material source.

5.1. ADOPTION AND KNOWLEDGE LEVELS AND TECHNOLOGIES

5.1.1. The Influence of Benefits on Adoption Levels

Current and future adoption levels indicate that approximately half (51%) of the primary wood product companies from Canada and the United States will be chain of custody certified within the next five years. Thirty-nine percent of the companies were already chain of custody certified at the time of this study and 12% were planning on becoming certified.

An obvious question is whether there are any factors that may influence/change the adoption levels of chain of custody certification. The benefits accrued from chain of custody certification seem to play a major role in whether or not a company will become certified. The comment of one non-certified respondent illustrates this point: "So far, consumers have not indicated a willingness to pay more for certified products. When they will do so, we will participate." Interestingly, non-certified companies identified a lack of benefits as the most important reason why they are not becoming certified (Figure 4-15).

Benefits for certified companies in the form of marketing incentives are, in fact, an important part of what forest certification proposes (Upton and Bass 1995). However, many chain of custody certified companies seem to be disappointed by the lack of benefits from the process. A certified respondent illustrates this idea: "So far, I can see no benefits for sales [of certified products] - the most important reason to go through it [i.e. chain of custody certification]." Another certified respondent commented: "We have been frustrated with our chain of custody certification because it has not resulted in access to new markets or access to certified woodlands." The gaining of benefits from chain of custody certification by certified companies is an important and useful way of promoting chain of custody certification and helping to increase its adoption.

5.1.2. Communication and Future Adoption Levels

Chain of custody certification is a concept that was originated in order to address society's concern with the degradation of natural resources and, thus, it aimed to improve forest

management (Fanzeres and Vogt 2000, Upton and Bass 1995). Some authors defend that the dissemination of concepts and ideas like chain of custody certification is nothing more than a marketing process (Fine 1981, Kotler and Roberto 1989). Fine (1981) also defends that socially beneficial ideas will find increased efficacy in their efforts to educate target audiences through marketing strategies.

In a broad sense, marketing is the dissemination of information and education about a product, service, or idea (Fine 1981). According to Fine (1981), no matter the product being marketed, it is important to communicate information about the benefits of the product/idea to the consumer. Certification bodies stated that they usually provide educational programs as a means of helping companies to obtain benefits from chain of custody certification. These programs provide assistance and clarification about chain of custody certification. The fact that companies seem to be more knowledgeable about aspects of chain of custody certification covered by these educational programs (Figure 4-8) indicates that these programs seem to be effective. However, it may also indicate that companies are searching for more information on this topic. Several respondents stated that they know nothing or little about chain of custody certification, while others requested more information about it. Shibutani (1966) cited by Fine (1981) defends that the communication of an idea/concept must contain relevant information to the group being targeted. He defends that the lack of relevant information will either make the group take whatever information it can get or it will create it.

Thus far, certification organizations are the main source of information on chain of custody certification. It is important to identify what types of information companies are demanding, as well as to identify the most efficient way of communicating these ideas. The use of a marketing approach may prove to be a very efficient way of transmitting information about chain of custody certification, which may in turn positively affect its adoption.

5.1.3. Tracking Technologies

An important technical aspect of chain of custody is the capacity to track material source in any phase of the manufacturing process and at any level of the supply chain. Certified companies identified paint daubs as the most used technique for tracking material source (Figure 4-19), which is in accordance to Groves et al. (1996). Groves et al. (1996) also indicated that barcode labels were a commonly used technology and respondents confirmed this trend (Figure 4-19).

5.2. BENEFITS AND COSTS AS A FUNCTION OF COMPANY TYPE

5.2.1. Expected versus Perceived Benefits

Certified and non-certified companies demonstrated similar attitudes with respect to the benefits of chain of custody certification; on average, responses from both types of companies ranged from disagreement to a lack of opinion on a number of statements related to benefits (Figure 4-25). In general, non-certified companies tend to have a more negative view of the benefits of chain of custody certification. As one non-certified respondent stated: "There are no benefits. Chain of custody certification is only an effort to appease environmental groups." The fact that, on average, certified companies do not perceive that they are receiving benefits from chain of custody certification does nothing to change this image.

Why are certified companies not receiving benefits from chain of custody certification? One possible explanation is the fact that companies may be expecting direct benefits when, in fact, most of the benefits are indirect. A comment from a certified respondent supports this claim: "There really have not been tangible short term benefits [from chain of custody certification]." Investments in responsible activities like forest certification usually improve the reputation of a firm, which may result in improved competitive advantage and, thus, in increased profitability (Miles and Covin 2000). In other words, the benefits associated with chain of custody certification are usually both long-term and indirect.

Immaturity of the market for certified wood products may be another explanation for the perceived lack of benefits. According to Humphries et al. (2001), market immaturity is responsible for the lack of premium prices that most certified companies are verifying. Premium prices are a direct benefit and are generally thought of as the main benefit from chain of custody certification. A certified respondent confirmed this notion: "Chain of custody certification is a failure until there is a market driven demand for finished certified products. (...) We do believe in chain of custody certification, but we have no economic reason for this opinion." Another certified respondent complements this line of thinking: "[Chain of custody certification provides] No premium, no advantages, no market share. [Only] Higher costs [and] more paperwork." The lack of premium prices for certified products helps to perpetuate the image that chain of custody certification does not bring companies any benefits. It is necessary to clarify the types of benefits resulting from chain of custody certification so that companies do not have misguided expectations about these benefits.

The long term and indirect nature of benefits from chain of custody certification as well as the immaturity of the market for certified forest products are leading forest certification to become a necessary factor; companies are having to consider forest certification in order to maintain their competitiveness. The image that direct and immediate benefits would result from chain of custody certification gave companies the idea that once they became certified they would necessarily have positive and visible results. In fact, the first companies to explore certification as a market tool verified benefits this way. Seven Islands Land Company from Maine and Collins Pine Company from Oregon are good examples of early entrants that obtained almost immediate and positive results from forest certification (Knudson 1995).

As more companies became chain of custody certified it became clear that these successful stories would not be a common rule. Nevertheless, companies were still verifying considerable pressure from society and environmental groups. Even though these pressures may still be an important factor in influencing companies to become chain of custody certified, most companies do not know if or expect that their certified status will prevent conflict with

environmental groups or improve their communication with social groups (Figure 4-25). One possible explanation may be the great gap that exists among the ideology of companies and environmental groups; both groups disagree greatly on how environmental related issues should be addressed. One non-certified respondent illustrates this idea: "If adopting chain of custody certification would place an end to the continual attack by environmental groups (...), industry would incur the costs and move ahead. The truth is that opposition to harvesting wants a zero cut and will not let up until industry is dead."

5.2.2. Costs and Company Size

Costs of chain of custody certification were always considered to be one of the major problems of the process (Upton and Bass 1995, Vlosky and Ozanne 1995, Groves et a. 1996, Hansen 1997, Hansen and Juslin 1998, Estey 2000). Information that certification bodies provided on the average range of costs for chain of custody assessments, annual audits, and certification renewals every five years show that chain of custody certification is not as expensive as it is believed to be. However, the costs of implementing chain of custody for a company are seem to be high, especially for smaller companies that do not have quality management systems in place. According to certification bodies, small companies are the ones that usually verify higher implementation costs.

The development of methods that aim to reduce costs may be the solution to one of the major problems of chain of custody certification. Certification bodies may have found an answer; they are simplifying and making the implementation of chain of custody certification less expensive by trying to adapt to whatever systems companies already have in place.

5.2.3. The Effect of Company Type on Benefits

The cluster analysis of perceived and expected benefits indicated an interesting trend: a possible relationship between attitudes towards benefits from chain of custody certification and certain characteristics of companies, especially company size. Moreover, costs of implementing

and maintaining chain of custody may be a major factor affecting the way companies perceive benefits (Figure 5-1).

Cluster 1 was composed of smaller companies when compared to the other two clusters (refer to Table 4-17). On average, companies in this cluster disagree that chain of custody certification will bring them any benefits. This fact may indicate that smaller certified companies are not obtaining any benefits from chain of custody certification, with possible explanations being the high costs of implementing chain of custody for these companies and a general lack of funds for the promotion of their certified products. The interviewed certification bodies explained that small companies have higher implementation costs when compared to large companies. This happens because small companies usually do not have a quality management system in place, and the implementation of a tracking system can be very expensive. Smaller companies also have less, if any, funds available for promotion and marketing campaigns of their certified products. Promotional campaigns are important to communicate the characteristics of a product to customers. They may result in several benefits to the companies, such as the ability to command higher prices in the marketplace, to increase demand, and to differentiate a product (Beckman et al. 1982). Thus, the lack of funds for promotion and marketing campaigns may decrease their chances of achieving the desired benefits from chain of custody certification.

Larger companies were allocated into the remaining two clusters. A group of larger companies that have no opinion about the benefits of chain of custody certification occur in Cluster 2 (Table 4-17). Companies in this cluster may have one of the following attitudes: (1) the company has not decided what to think about chain of custody certification; or (2) they do not believe that chain of custody certification is an important issue. The comment of one non-certified company belonging to this cluster illustrates this idea: "We are currently watching to see what the market demands. We have ISO 14001 certification, but have decided to wait to see which land based certification scheme gains the most momentum." In fact, this cluster has the smallest proportion of certified companies and it is also the largest cluster of the three. This may be an interesting target group for the promotion of chain of custody certification.

The other group of larger companies belongs to Cluster 3. On average, companies in this cluster agree that chain of custody certification can bring them some benefits (Table 4-17). Interestingly, this was the cluster with the greatest proportion of certified companies. According to the certification bodies, large companies have lower costs of implementing chain of custody because they usually have a quality management system established. Certification bodies also explained that large companies invest more in marketing and promotional campaigns of their certified products, which may help these companies to verify the potential benefits of chain of custody certification.

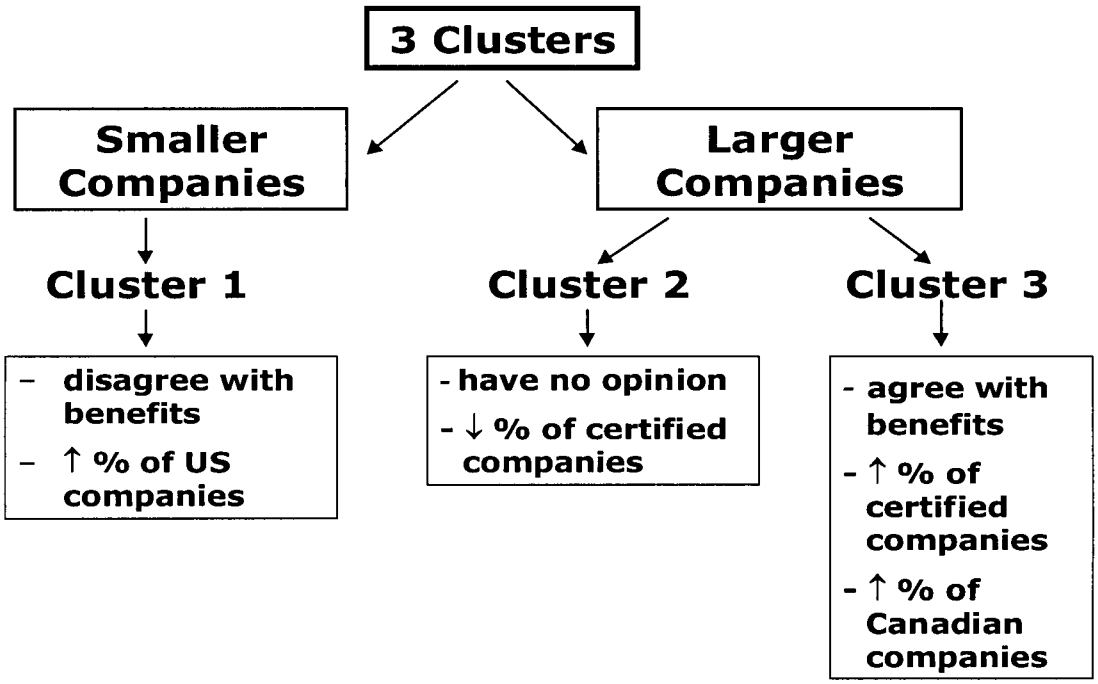

Figure 5-1: Company type and perception of benefits.

5.2.4. Influence of Company Size on Certification Status

The discriminant function analysis confirmed the trend indicated in the cluster analysis. The classification functions of the discriminant function analysis showed that the greater the number of product lines and number of employees that a company has, the greater the likelihood of that company being chain of custody certified. This indicates that the certification status of a

company may be linked to the size of the company. However, it is necessary to be careful when determining which variables are to be used to measure company size. In the case of this analysis, sales revenues of companies, which is often considered a measure of company size, was not helpful in separating chain of custody certified and non-certified companies.

The fact that sales revenue is not a determinant variable of the certification status of a company may indicate that characteristics related to the manufacturing process of the company, like number of employees and number of product lines, may be the most determinant variables. Usually, the more complex the manufacturing process of a company, the more organized that company has to be in order to remain competitive. Thus, these companies are more likely to have good manufacturing and quality control systems in place. As showed earlier, the existence of some type of a quality management system facilitates the implementation of chain of custody certification and also decreases the costs of certification for that company.

5.3. RESEARCH LIMITATIONS AND SUGGESTIONS

5.3.1. Telephone Interviews with Certification Bodies

Accredited certification bodies were interviewed in order to complement the information collected from companies. The telephone surveys were designed based on the mail surveys for companies in order to collect the same type of information about chain of custody certification. Even so, it was expected that interesting information would be collected because it came from a group with different points of view about this topic. Thus, it would be possible to compare information and attitudes from the two groups.

The telephone surveys were conducted during the implementation phase of the mail questionnaires for companies. However, after analyzing the data of both surveys, it became clear that the telephone interviews with certification bodies should have been done before the implementation of mail questionnaires. This way, some of the data collected in the telephone surveys could have provided additional guidance in the design of the questionnaire for companies.

Fortunately, this course of action did not result in any serious problems with this study. Questions regarding costs of chain of custody certification were most affected. Specifically, the ranges of costs presented in the questionnaire were off, which resulted in lack of precision on information regarding the costs of the process. However, the combination of data on costs from both surveys made it possible to collect some of the information sought in this study. It also rendered good insights in the comparison of data from both surveys.

A suggestion on further studies on this topic would be to include these types of interviews as part of the exploratory research. They provide clarification and useful insights that can be of great assistance in the design of questionnaires.

5.3.2. Classification Functions

Classification functions were one of the outcomes of the discriminant function analysis. These types of functions are used to predict group membership and can be a useful tool when preparing strategies for the promotion of chain of custody certification. Information on the types of companies that are more likely to become certified will help to identify better ways of influencing companies towards chain of custody certification. The classification functions for the data in this study presented an acceptable success rate; however, it should be used carefully when a great precision of future group membership is necessary.

Other discriminant variables could be included in the analysis in order to improve the success rate of these functions. Suggestions for further studies include the addition of a variable specifying the number of manufacturing facilities for each company and other variables that can measure the complexity of manufacturing processes.

6. CONCLUSION

Chain of custody certification is exerting a new pressure over primary wood products companies. More than ever, companies are having to consider this issue and make decisions on whether or not adopt this program. For this, they usually seek information about the implementation of chain of custody certification, including descriptions of the characteristics, requirements of the process, costs and benefits. However, little information can be found on these aspects of chain of custody certification, which may be affecting the adoption levels for this program.

Currently, 39% of the primary wood products companies from Canada and the United States are chain of custody certified, 12% are planning on implementing chain of custody strategies within the next five years, and 49% have no intention of becoming certified in the near future. It seems that the adoption levels of chain of custody certification are very much connected to the idea of obtaining benefits from this process. On average, certified companies do not perceive that they are receiving benefits from chain of custody certification, which helps to perpetuate the idea that chain of custody certification is not effective.

The image that chain of custody certification does not bring companies any benefits may be the result of misleading information and expectations. Companies usually expect premium prices and other direct benefits from chain of custody certification, when in reality, most of the benefits are indirect and long-term. More effective communication strategies should be used to make companies aware of the real benefits of chain of custody certification.

Communication and marketing strategies may also be the key to better dissemination of the concept of chain of custody certification. An understanding of the types of information that primary wood product companies are demanding will allow certification bodies to convey the most relevant information to this target group. Thus, the use of a marketing approach may be a very effective way of educating companies about the concept of chain of custody certification and increasing its adoption level.

According to the results of the cluster analysis, the way that primary wood products companies perceive benefits of chain of custody certification is related to the size of the company and its location. In general, smaller companies do not perceive that they are receiving benefits from chain of custody certification as do a higher proportion of American companies. Larger companies are divided into two groups: one that has no opinion about the benefits from chain of custody certification and another that agrees that chain of custody certification can bring them benefits. The group of larger companies that has no opinion about benefits of chain of custody certification had the lowest proportion of certified companies, which makes this group an interesting target group for the promotion of this concept. The group of larger companies that agrees that chain of custody certification can bring them benefits had the highest proportions of certified and Canadian companies.

Company size is also related to two other aspects of chain of custody certification: implementation costs and the certification status of a company. The larger the company, the smaller the implementation costs of chain of custody certification tend to be. Large companies usually have quality management systems in place, while small companies do not. Thus, small companies end up having higher implementation costs.

Results of the discriminant function analysis indicated that the larger the company, the higher the chance of that company being chain of custody certified. However, only measures of company size related to the manufacturing process seem to be effective in indicating its certification status. Companies with complex manufacturing processes are more likely to have quality management systems in place, facilitating the implementation of chain of custody.

Chain of custody certification is a broad topic that can be affected by several different variables. This study concentrated on just some of the aspects concerning chain of custody certification. Moreover, chain of custody certification is in constant evolution due to the fact that it is a concept in a relatively early phase of its development. Further studies concentrating on different characteristics of chain of custody certification for primary wood products companies would be very useful in the guidance of further research on this topic.

Among the information collected in this study, the result that may be the most effective in advancing the development of chain of custody certification in a relative short time is the use of marketing strategies to educate companies about this concept. As a closing remark, the comment of one certified respondent summarizes the problems that chain of custody certification faces: "The biggest problem [of chain of custody certification] is the lack of understanding on the simplicity of the system. Many fear a great deal of additional work, but do not have an understanding of the requirements. Also, the lack of visible benefits is discouraging and prevents people from following through."

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APPENDIX I: MAIL QUESTIONNAIRE FOR COMPANIES

Survey on Chain of Custody Certification for Primary Wood Products Companies in North America

This survey concerns primary producers of chip and veneer logs, lumber, timbers, and veneers. If this does NOT apply to your company, please check the following box and return in the addressed envelop included. ❒ **Does NOT apply**

In answering the questions of this survey, please keep the following definition in mind:

Chain of custody certification: Assurance granted by a third-party certification organization that the wood purchased really comes from an environmentally certified source.

Section 1 – Adoption Level and Level of Knowledge

1. Is your company chain of custody certified?
   ❒ Yes (Please go to **Section 2** – page 2) ❒ No

4. Does your company plan on becoming chain of custody certified within the next 5 years?
   ❒ Yes ❒ No (Please, go to **question 7** – page 2)

5. If your company has plans to achieve chain of custody certification within the next 5 years, which of the following accredited certification bodies would likely be used? (Please check all that apply.)

   ❒ SmartWood (FSC) ❒ Silva Forest Foundation (FSC) ❒ KPMG ❒ Other_____
   ❒ SGS – Qualifor (FSC) ❒ Canadian Standards Association ❒ PricewaterhouseCoopers _____ (Please specify)
   ❒ Scientific Certification System (FSC) ❒ Sustainable Forestry Initiative (AF&PA) ❒ Don't know

6. Please rate your level of knowledge for each of the following steps in chain of custody certification? (Select one for each case.)

	VERY KNOWLEDGEABLE	SOMEWHAT KNOWLEDGEABLE	NOT VERY KNOWLEDGEABLE	NOT AT ALL KNOWLEDGEABLE
a) Segregation of certified raw material	❒	❒	❒	❒
b) Implementation of tracking technologies and methods	❒	❒	❒	❒
c) Chain of custody assessments	❒	❒	❒	❒
d) Annual audits	❒	❒	❒	❒
e) Certification renewals (every 5 years)	❒	❒	❒	❒

7. This question asks about the costs of chain of custody certification for a *typical* product line. Please give example(s) of product line(s) in your company and state the product that you will use to answer this question.

   Example(s) of product line(s) in your company: _____

   Product used to answer this question:_____

   a) What do you expect the total cost (in US dollars) of *implementing* chain of custody for a typical product line in your company to be (i.e. making the necessary changes)?

❒ under $25,000	❒ $25,001 - $50,000	❒ $50,001 - $100,000	❒ $100,001 - $150,000	❒ $150,001 – $200,000	❒ $200,001 and over

   b) What do you expect the total cost (in US dollars) of *auditing* chain of custody for a typical product line in your company to be?

❒ under $10,000	❒ $10,001 - $25,000	❒ $25,001 - $50,000	❒ $50,001 - $100,000	❒ $100,001 – $150,000	❒ $150,001 and over

c) What do you expect the total cost per year (in US dollars) of *maintaining* chain of custody for a typical product line in your company to be (i.e. annual audits and renewals)?

❒ under $25,000	❒ $25,001 - $50,000	❒ $50,001 - $100,000	❒ $100,001 - $150,000	❒ $150,001 – $200,000	❒ $200,001 and over

8. What do you expect the three most expensive factors to be when implementing chain of custody strategies in your company? (Rank from 1 to 3, with 1 being the most expensive.)

a) segregation of raw material _____
b) implementation of tracking technologies and methods at your manufacturing facility _____
c) chain of custody assessments (on-site evaluation that leads to certification decisions) _____
d) maintenance of certification conditions (annual audits + certification renewals every 5 years) _____
e) other _____ _____
(Please specify)

9. Assuming that your company becomes chain of custody certified, please estimate the proportion of the total raw material used that would be from *non-certified* sources. _____%

10. Which of the following would you consider to be the customers of your company's chain of custody certified products? (Please check all that apply.)

❒ industrial customers ❒ retailers ❒ builders ❒ other _____
❒ end users / consumers ❒ wholesalers ❒ architects and engineers _____
(Please specify)

11. Which of the following benefits would you expect from chain of custody certification? (For each statement, please circle one number indicating your level of agreement.)

1 – Strongly agree
2 – Agree
3 – Neither agree nor disagree
4 – Disagree
5 – Strongly disagree

CHAIN OF CUSTODY CERTIFICATION WILL PROVIDE MY COMPANY WITH...

... better inventory control.	1	2	3	4	5
... waste reduction.	1	2	3	4	5
... increased profitability.	1	2	3	4	5
... increased market share.	1	2	3	4	5
... maintenance of market share.	1	2	3	4	5
... increased overall efficiency.	1	2	3	4	5
... clearer information to investors.	1	2	3	4	5
... enhanced understanding of consumer markets.	1	2	3	4	5
... improved communication with the government.	1	2	3	4	5
... improved communication with customers.	1	2	3	4	5
... improved communication with social community groups.	1	2	3	4	5
... reduced pressure from environmental organizations.	1	2	3	4	5
... better public relations.	1	2	3	4	5

12. Can you think of any other benefits that chain of custody certification might bring to your company? Please specify.

_____
_____
_____

13. If your company does NOT have plans to become chain of custody certified within the next 5 years, please rank the following reasons for making this decision in order of importance. (Please rank from 1 to 3, with 1 being the most important reason.)

a) It will not bring any benefits for this company. _____
b) There is a lack of information about chain of custody certification. _____
c) There is a lack of incentive from the government. _____
d) The implementation cost of chain of custody certification is too high. _____
e) This company already uses wood from sustainably managed forests. _____
f) We do not agree with the idea of chain of custody certification. _____

g) It will not affect this company's market share

STOP!!! The remainder of this survey concerns primary wood product manufacturing companies that are chain of custody certified. If your company does not manufacture primary wood products or is not chain of custody certified, please proceed to Section 4. Thank you!

Section 2 – Company's Certification Information

1. Which of the following accredited certification bodies have certified your organization? (Check all that apply.)

❒ SmartWood ❒ Scientific Certification System ❒ Canadian Standards Association ❒ other _____

❒ SGS - Qualifor ❒ Silva Forest Foundation _____ (Please specify)

2. Who are the customers for your company's certified products? (Check all that apply.)

❒ industrial customers ❒ retailers ❒ architects and engineers ❒ other _____

❒ end users / consumers ❒ wholesalers ❒ builders _____ (Please specify)

3. What types of wood does your company use to manufacture the certified products? (Check all that apply.)

❒ softwoods ❒ non-tropical hardwoods ❒ tropical hardwoods ❒ other _____ _____ (Please specify)

4. Please provide the following information about the primary wood product line(s) (chain of custody certified *and* non-certified) that your company produces:

Product Line	Approximate sales revenue (in US dollars) of each product line in 2001	Is this product line chain of custody certified?	Proportion of certified raw material used in each product line
1.	US$ _____	❒ Yes ❒ No	_____%
2.	US$ _____	❒ Yes ❒ No	_____%
3.	US$ _____	❒ Yes ❒ No	_____%
4.	US$ _____	❒ Yes ❒ No	_____%

5. Does your company supply *all* of its logs? ❒ No ⇩ ❒ Yes (Please go to **question 7**)

a) How many suppliers of logs does your company have? ⇨ _____ # of suppliers

b) How many of these supply certified logs? _____ # of suppliers of certified logs

7. Which of the following technologies does your company use to track material source? (Please select all that apply.)

❒ **Paint daubs** indicating the forest of origin, species, and volume.
❒ **Labels** indicating the forest of origin, species, and volume.
❒ **Hammermarks** made at the time of felling to identify the forest of origin.
❒ **Latshbacker tags** – numbered plastic labels.
❒ **Barcode labels** attached to the product.
❒ **Radio-frequency identification devices** – pre-programmed computer chips.
❒ **Touch memories** – battery-powered computer chips in a circular metal housing.
❒ **Other** _____ (Please specify)

8. This question asks about the costs of chain of custody certification for a *typical* product line. Please state the product that you will use to answer this question.

Product used to answer this question: _____

a) What was the total cost (in US dollars) of *implementing* chain of custody for a typical product line in your company (i.e. making the necessary changes)?

❒ under $25,000	❒ $25,001 - $50,000	❒ $50,001 - $100,000	❒ $100,001 - $150,000	❒ $150,001 – $200,000	❒ $200,001 and over

b) What was the total cost (in US dollars) of *auditing* chain of custody for a typical product line in your company?

❒ under $10,000	❒ $10,001 - $25,000	❒ $25,001 - $50,000	❒ $50,001 - $100,000	❒ $100,001 – $150,000	❒ $150,001 and over

c) What is the total cost per year (in US dollars) of *maintaining* chain of custody for a typical product line in your company (i.e. annual audits and renewals)?

❒ under $25,000	❒ $25,001 - $50,000	❒ $50,001 - $100,000	❒ $100,001 - $150,000	❒ $150,001 – $200,000	❒ $200,001 and over

Section 3 – Benefits and Difficulties

1. Please rank the three greatest difficulties that your company faced when implementing chain of custody certification?
(Please rank the following alternatives from 1 to 3, with 1 being the most difficult issue.)

a) lack of information about the process _____
b) lack of government collaboration _____
c) high costs _____
d) insufficient supply of certified wood _____
e) material segregation _____
f) employees' training _____
g) other _____ _____
(Please specify)

2. What benefits has chain of custody certification brought to your company?
(For each statement, please circle one number indicating your level of agreement.)

1 – Strongly agree
2 – Agree
3 – Neither agree nor disagree
4 – Disagree
5 – Strongly disagree

CHAIN OF CUSTODY CERTIFICATION HAS PROVIDED MY COMPANY WITH...

... better inventory control.	1	2	3	4	5
... waste reduction.	1	2	3	4	5
... increased profitability.	1	2	3	4	5
... increased market share.	1	2	3	4	5
... maintenance of market share.	1	2	3	4	5
... increased overall efficiency.	1	2	3	4	5
... clearer information to investors.	1	2	3	4	5
... enhanced understanding of consumer markets.	1	2	3	4	5
... improved communication with the government.	1	2	3	4	5
... improved communication with customers.	1	2	3	4	5
... improved communication with community groups.	1	2	3	4	5
... reduced pressure from environmental organizations.	1	2	3	4	5
... better public relations.	1	2	3	4	5

3. Can you think of any other benefits that chain of custody certification brought to your company? Please specify.

_____
_____
_____

Section 4 - Profile

1. Where is your company located?

City/Town: _____

State/Province: _____

Country: _____

2. Please indicate the approximate sales revenue of your company in 2001: US$_____
3. What is the approximate number of employees in your company? _____ # of employees
4. Please indicate the total number of product lines in your company: _____ # of product lines
5. Would you like to make any additional comments about chain of custody certification?

Thank you for your time and cooperation in answering this survey!
If you would like a summary of the results of this survey, please include your name and address below, and it will be sent to you!

Company name: _____

Contact: _____

Address: _____

_____

Please mail (addressed envelope included) or fax to Natalia Vidal at (604) 822-9104

APPENDIX II: TELEPHONE SURVEY FOR CERTIFICATION BODIES

Certification Bodies Telephone Survey

(INTRODUCTION)

- CHECK NUMBER – Is this _____?

(name of the organization)

(IF NOT, TERMINATE INTERVIEW WITH, E.G.: I'm sorry, I have the wrong number.)

- This is _____ from the University of British Columbia. I'm calling from the Forest Products Marketing Group at the Faculty of Forestry. We are conducting a North American research study in order to find out the current level of knowledge and status of chain of custody certification for the primary wood industry. So, our study includes those companies that manufacture their products from logs and organizations that directly deal with chain of custody certification like yours. You were selected from a list of accredited certification bodies provided by major certification organizations.

- Last week a letter was sent to you explaining a little about this study. Did you receive it?

(IF NOT → I'm sorry yours didn't reach you. It was a brief letter we sent so that people would know that we would be calling them.)

- The questions I need to ask you should take up to 20 minutes. I want to add that I would be happy to answer any questions you might have about the study, either now or later, OK?

SECTION 1 (ADOPTION LEVEL)

1. First, I would like to ask you if your organization does chain of custody assessments?

   YES (GO TO QUESTION 3)..... 1

   NO 0

   ⇩

2. Would you say that your organization is planning on working with chain of custody certification within the next 5 years?

   NO (TERMINATE)..... 0 ⇨ This is a survey for accredited certification bodies that do chain of custody assessments or are planning to work with it in the next 5 years. I would like to end the interview with some basic profile questions. (GO TO SECTION 4 – SKIP INTRO)

   YES 1

   ⇩

3. Which certification organization has accredited your institution?

   _____

   (DO NOT DO *COC* → GO TO SECTION 2)

   (DO *COC*)

   ⇩

4. Could you estimate the number of primary forest products companies that are chain of custody certified by your institution at the present time? I'm referring only to those companies that manufacture their products from logs.

   _____ COMPANIES

5. Are there any primary forest products companies currently in the process of chain of custody certification?

   NO (GO TO SECTION 2)..... 0

   YES 1

   ⇩

   How many? _____ COMPANIES

SECTION 2 *(COSTS)*

- Next I want to ask you about the costs of certification for companies interested in chain of custody. (FOR CERTIFICATION BODIES THAT *DO NOT* DO COC USE THE EXPRESSIONS IN PARENTHESIS)

1. First, I want to ask you how your organization measures (plans to measure) the costs of chain of custody certification. For example, the unit used in forest management certification is dollars per hectare. Does your organization use some kind of unit for measuring the costs of chain of custody certification?

   NO (GO TO QUESTION 2) 0

   YES ⟹ UNIT: _____ 1

2. What are the parameters used (that will be likely used) by your organization to determine the price charged for chain of custody assessments, annual audits, and renewals? (PARAMETERS E.G.: # of product lines to be certified, size of the company, etc.)

   _____

   _____

   _____

   _____

3. What do you estimate the range of costs in US dollars to be for a chain of custody assessment? We don't need exact costs, just approximations.

   FROM: US$ _____

   TO: US$ _____

   COMMENTS: _____

   _____

4. Could you estimate the range of costs in US dollars for each annual audit?

   FROM: US$ _____

   TO: US$ _____

   COMMENTS: _____

   _____

5. How about the range of costs in US dollars of the certification renewal every 5 years?

   FROM: US$ _____

   TO: US$ _____

   COMMENTS: _____

   _____

6. To finish the questions about costs, could you give me an estimate of the annual indirect costs in US dollars of implementing chain of custody certification for a company? Examples of indirect costs would be material segregation, implementation of new technologies to track the wood down, employee training, etc.

   US$_____/YEAR

   COMMENTS:

   _____

   _____

   _____

   _____

SECTION 3 (*BENEFITS*)

- Next, I'll ask some few questions about the possible benefits that can result from chain of custody certification

  (FOR CERTIFICATION BODIES THAT *DO NOT* DO COC USE THE EXPRESSIONS IN PARENTHESIS)

1. I am going to read to you 5 benefits that could possibly be generated from chain of custody certification. For each statement, please indicate whether you strongly agree, agree, have no opinion, disagree or strongly disagree.

1 – strongly agree
2 – agree
3 – no opinion
4 – disagree
5 – strongly disagree

	AGREE				DISAGREE
(a) First, do you strongly agree, agree, have no opinion, disagree or strongly disagree that chain of custody certification is providing (will provide) companies with better inventory control?	1	2	3	4	5
(b) Do you strongly agree, agree, have no opinion, disagree or strongly disagree that chain of custody certification is providing (will provide) companies with increased market share?	1	2	3	4	5
(c) Do you think that chain of custody certification is helping (will help) companies to maintain their market share?	1	2	3	4	5
(d) Do you think that chain of custody certification is helping (will help) companies to improve communication with stakeholder groups?	1	2	3	4	5
(STAKEHOLDERS E.G.: Stakeholders in this case include customers, investors, government, environmental groups, communities, etc.)					
(e) Do you think that chain of custody is helping (will help) companies to increase their profitability?	1	2	3	4	5

2. Can you think of any other benefit or benefits that chain of custody certification might bring to primary wood products companies?

NO (GO TO QUESTION 3) 0

YES 1

⇩

_____

_____

_____

3. Does (Will) your institution provide support beyond certification in assisting certified companies to acquire these benefits?

NO (GO TO SECTION 4)..... 0

YES 1

⇩

How? _____

_____

4. Would you like to make any additional comments about chain of custody certification for primary forest products companies?

SECTION 4 *(DEMOGRAPHICS)*

- Okay, we have finished the technical questions. Now, to end the interview, I would like to ask you some basic profile questions.

1. In what city is your institution located? _____

   State/Province? _____

   Country?_____

2. Would you like to receive a summary of the results of this survey?

   NO (TERMINATE) 0

   YES 1

   ⇩

What is the complete name of your institution?

_____

Would you like to have your name included on the envelope?

NO YES _____

⇩

The address of your institution:

_____

_____

_____

The interview is complete. Thank you for your time and cooperation! Have a nice day!

APPENDIX III: COVER LETTERS

APPENDIX IV: ANSWERS OF THE OPEN-ENDED QUESTIONS

S1Q10 – Can you think of any other benefits from chain of custody certification? (only non-certified companies answered this question)

No, there is no demand for this product.
Should chain of custody certification be implemented consistently throughout industry, then the "renegade" logging companies would be eliminated, and thus protecting the environment, balancing the competition field, etc.
May increase margins, but it is not likely because of the industry competition.
It may get us a couple of better paying orders.
All aspects are negative for small privately owned companies.
We may be able to supply products that competitors cannot.
My friends would have one more thing to tease me about.
I believe that going to chain of custody certification is an acknowledgment that we do not practice sustainable forest management, which is ludicrous because it is poor business - all it does is confuse the consumer, mislead the public.
This is wrong - This is giving up control of private property to government and quasi government agencies. Whether government owns or controls, the results are similar to private prop owner – government tax incentives are an unconstitutional way of gaining control of private property - the elastic clause is stretched beyond reason.
The added cost will amplify the already high cost of doing business in Eastern NY, thus making the decision to close manufacturing operations easier.
Lots of paperwork and pain in the butt
Use more paper so pulp is more valuable.
We feel that acceptance of the "certified doctrine" will lead to increased regulation, and ultimately, damage the resource.
There are no benefits. Chain of custody certification is only an effort to appease environmental groups. They will never stop. Look at the harvest on the Tungass National Forest for example.

S3Q3 – Can you think of any other benefits from chain of custody certification? (only certified companies answered this question)

If you make your living in wood products you must be aware that the resource is manageable. It is necessary to assure that the resource will survive as long as men survive.

It won't be successful until more suppliers (logs) become certified.
Strengthened relationships with suppliers.
Largest benefit is market access.
It is too early to say as we have not been able to gain a consistent supply of certified raw material.
Not yet. If the market develops, we will be there in the first row.
We have been committed since the inception. To date we have experienced more frustration than benefits. We remain committed and hope supply will catch up in the future.
Added additional product lines/market awareness for our company.
Employee morale - recruitment. New business (non-FSC) are customers of like mind.
Personal satisfaction.
I don't think you truly understand what you are dealing with. I am one of the first sourcing companies for FSC.
Actually, no other benefit than to help retailers to keep environmental extremers from chaining themselves to their displays!
Some exposure in the marketplace.
It gives Uncle Sam one more chance to stick his nose in my business. It has created jobs for College dombasses do lazy work for a living.
Largest hoax perpetuated on an industry in last 50 years (rivals ENRON).
Unique market niche. Deflect "big box" marketing. Proactive leader in growing market. Enhance image in local environmentally con.
New markets for wood products and greater demand.
No, because we have not filled any chain of custody certification orders yet.
Forced us to look at our material flow and create on paper a schematic production model.
No benefits whatsoever.
No!
The only area that we have found chain of custody certification useful is in having the certification number. It has not increased our sales nor provided us with a premium product.
We are in the FSC certified business because large customers are in need. At this time it not profitable for anybody - large shortage of material.
There are no benefits.

Ability to move products during slow times.
Not yet, have not sold any certified wood.
Propaganda.
Employee pride.
There really have not been any tangible short term benefits.

S4Q5 – Any additional comments on chain of custody certification? (answers from both certified and non-certified companies)

Certification has helped US to achieve sales to customers who demand FSC certification. Otherwise, our non-certified competitors would likely have an edge due to more competitive pricing.
As mentioned earlier, we have not certified or labeled wood that we have processed primarily due to a limited supply of FSC wood. In question 2 (section 3) most of the answers were in disagreement with the statement because I feel we have those issues in control already - if a company does not, it would force them to do so. The FSC chain of custody certification is a very cumbersome process. The certification scheme from the SFI would be a much better process if accepted.
Chain of custody certification is cumbersome and ultimately does not change forest practices. There are real costs, many hidden, that you haven't asked about.
Architects need to start writing "sustainable" specs, not just adding the words "FSC certified" in front of the usual spec.
I would like some information about it.
The LEED measurement system will open the architect's desire to go "sustainable".
Never heard of chain of custody certification.
Certification does nothing to improve forest sustainability. If the certification movement should cause a shift away from wood, which is environmentally sound, to non-renewable, high energy substitutes, it would have a negative impact on the environment. We have managed our timberlands in a responsible and sustainable manner for many decades. We don't need any hypocritical, self-serving environmental group to tell us how to manage our lands according to their flawed agenda. Consequently, we also don't need any burdensome, bureaucratic, chain of custody certification scheme.
Pandering to "feel good" people who don't exercise their mental capabilities.

Our hope of offering certified wood to keep market share has not materialized. A lot of business is going to China. We do not believe the consumer considers certification. We may not renew our certification.
This is a well intentional program but availability and prices do not justify the costs incurred.
Overall it is a good idea. However, due to the shortage of log supply it is impractical.
So far, I can see no benefits for sales - the most important reason to go through it. FSC is time consuming to complete. We take care of our forest anyhow - it's good business. Home Depot and Lowe's won't follow through it - their products cost 10% more.
We have no luck in finding a reliable source of logs for use year-around. This has made it difficult to market **any** products!
Chain of custody certification and sale of certified products has to date consumed extensive investments of time with little to no financial return. Lack of availability and non-competitive priced goods are our main problem. Consumers do not want to pay a premium for certified products while the mills want 20-30% premiums to recover their certification costs.
Chain of custody certification is not practical in the South given the ownership characteristics of the forest in this region. Attempting to institute it would result in an intellectually dishonest exercise. Absolutely no demand for certified products in our markets.
It is my belief that chain of custody certification is just another fancy name for more government-environmental control. Taxes and government regulations in the long run do more harm than the hardwood lumber manufacturers have ever done! Remember it: it is our own best interest to manage our forests for the future!
I was and I am one of the pioneers of FSC certified companies. Your questions miss the point with people like me.
We buy Forest Service timber. No one adequately deals with this problem. They are the worst managers of forest resources in the world; preach ecosystem management, but fail to manage sustainably. It is ironic that these organizations that have forced this marketing issue, appeal and litigate to keep the agency in gridlock and prevent sustainable management.
In the USA the government regulations are more than adequate to protect our resources. For certain schemes, they need to realize this is not a proper forum for cultural engineering.
Need more certified forests.
Why doesn't China have to comply?
It is not wanted or needed by the public or industry. FSC is just in it to live their on pockets.
Chain of custody certification is a failure until there is a market driven demand for the finished

certified products. I am sorry about my comments - we do believe in chain of custody certification, but we have no economic reason for this opinion.
On the East Coast of the US I would estimate that about 95% of the wood that is cut and delivered to mills and yards come from planted and/or managed forests. These tracts, once they are cut, will be replanted. Sustainable forestry is taught and practiced in this area. In recent years, cypress and hardwoods have been replanted as swamp is becoming more accessible. In my limited experience with certification, imported or exotic woods would, in my opinion, be worth certifying its origin. There are no government timber sales in this region. I feel that in my small business there is enough needless paperwork without certification.
We are in the midst of separating our primary manufacturing from our wholesale/retail sales. Our log milling facility is at a new site. We've only just begun to mill certified logs. New site is in Arcata, CA.
We have little knowledge of chain of custody certification.
Why do you not include FSC in S2 Q1?
We are CSA/ISO certified but not chain of custody certified.
House logs - limited lumber. Not applicable in Alaska (Interior) 99% of resource timber is State sales; 1% imported from Yukon - Canada (maybe)
Would like to see survey of secondary wood manufacturers - like us - we're certified (SmartWood) and happy to answer any related questions.
Most of our raw material is purchased from government agencies or timber companies that already have strict environmental standards in place. Even small open market producers must abide by WA State Forest Practice regulations for harvesting timber.
I have personally seen no advantage to a company our size to be certified. It just gives the bigger companies more control over smaller ones. If companies and their sources for raw materials follow the guidelines set by state & federal governments and government agencies police then there should be no reason for certification.
Serving architecture/design community, we have two standards to try to appease. The expectation of a certain appearance of face veneers, and the availability of such. Putting the certification in the equation makes this not possible. It is this group that waves the green flag, yet it is NOT knowledgeable about what they are asking.
We are a small family operated mill, mainly cedar fence products and our wood source are often from logs the large mills do not want, i.e. too small or down and dead. We feel we are utilizing wood that cleans up the forest by buying these logs that otherwise would be left to feed a fire.

We became SmartWood certified two years ago. It costs around 2,000 per year to maintain. We imported 2T/L FSC Brazilian Cherry flooring. This is a very popular flooring wood. Our distributors showed NO interest. We take inquiries for flooring on our web site. We offered FSC last August. Since then we have had 200 inquiries of which 2 are FSC certified. The consumer is not asking for certified products. Besides good advertising, there are no benefits.
No premium, no advantages, no market share. Higher costs, more paperwork.
We are a small family owned business. We really don't know if our FSC COC 246 will help someday. However, if FSC is helping to stop destruction forestry around the world, we are proud to be involved in the effort.
120 species of veneer (only 2 certified) - 100 species of solid wood (no certified inventory).
At this time it has not been an issue, but that may change. Cost is unknown.
I really wish that people who work in this industry (forestry) were consulted or used when coming up with these environmental programs. The people who are trying to organize them are doing more harm than good - ever if they think they are preserving the environment. These programs are make projects for paper pushers and do not help the environment in the way that is intended or needed.
I think certification sounds good, but small primary wood producers don't have the TIME, MONEY, or LABOUR for all these processes that governments and public want them to achieve. It would be easier and cheaper to quit.
We're currently watching to see what the market demands. We have ISO 14001 certification but have decided to wait to see which land based certification scheme gains the most momentum.
The generation of Americans who drive the "environmental" debate refuse to pay the added costs of their activism. On balance, it has been a good thing to hold corporations and citizens responsible for environmental externalities, but the pendulum has swung too far. The American left-wing lumped intelligentsia that had its collective heart broken by the Soviet Union, will move into the next place where it is still possible to hate capitalism and hate America: environmentalism.
It does not work at this time. Large timber companies are reluctant to go FSC certified because NOT profitable. There is a shortage of FSC certified lumber.
It's a waste of time.
So far it is not something that is feasible for small companies.
Don't like the idea of someone or some organization telling how to run your business.
Chain of custody certification is a small piece of the pie when compared to the certification of

the forest land providing the raw material.
Concerning my attitude about forest certification and the chain of custody certification process which is associated with it, I am philosophically in agreement with the principles of certification. Unfortunately, I have developed a negative attitude concerning volumes of paperwork and quite frankly I dispense with rapidly, unless forced to do otherwise.
Consumer interest in certified products in the USA is too small to justify much investment in chain of custody certification or paying premiums for products.
Not interested!
Don't know what chain of custody certification is!
We have no plans for chain of custody certification. Due to the bad management of federal forest land (no logging), we must put more pressure on private land owners to survive, which is ridiculous. The federal forests (Shownee & Mark Twain) would be healthier if logging was permitted as originally intended. It is only a matter of time before we have fires like out west, due to dried fallen trees and no road access. Open up national forests; you'll have plenty of supply - no harm to environmentally risky areas.
So far consumers have not indicated a willingness to pay more for certified products. When they will do, so we will participate.
95% of our wood is from top logs that have no other use except firewood.
Chain of custody certification is a waste of time. Money is what motivates people. Do you think that someone will pay two dollars more for a 2x4 because someone took a course about green certification?
Appears to be impractical for dimension manufacturers and for sawmills that buy gatelogs from large number of suppliers inventory segregation and cost of carrying inventory would seem to preclude certification.
Out of business – certification was unknown by my customers and did me no good. Rogue Inst., my certifier, knew nothing about the industry and couldn't give a worthwhile audit report to save their lives
I am returning this to you because our lumber mill is no longer in business due to my husband's death in May 2000. Mrs. Thomas Hodgson.
We are a Ma & Pa operation. This is not something we will ever be concerned with. Please forward to another company. Our lumber + sawmill operation is usually less than 10,000/year.
I don't know anything about this certification process
Don't know what chain of custody certification is!

People still want to buy as cheap as possible. Cost is a major factor.
We feel that a chain of custody certification mandate will be detrimental to the forest industry. Certification is just another nail in the coffin for the timber industry. A viable, productive, and active timber base that is economically valuable is the best guarantee of sustainability.
If adopting chain of custody certification would place an end to the continual attack by environmental groups and ensure some predictable supply of timber for our mills in SE Alaska, industry would incur the cost and move ahead. The truth is opposition to harvesting wants a zero cut and will not let up until industry is dead.
We are not totally familiar about chain of custody certification.
Disappointing so far. Lack of customer interest to this point.
Move effort by government to educate the public and support small scale woodlots in their quest for certification. Although we have not sold any FSC certified wood, we have had a beneficial exposure to markets as a 'green' producer.
In process of COC certification – SmartWood assessment audit took place June 14/02. No problems anticipated.
Percentage based claims should have a high proportion of certified content. Current threshold from pulp and paper products for FSC are too low. Not meaningful.
The biggest problem is the lack of understanding on the simplicity of the system. Many fear a great deal of additional work but do not have an understanding of the requirements. Also, the lack of visible benefits is discouraging and prevents people from following through.
We are a very small company. Is it really worth any effort on our part?
We have been frustrated with our COC because it has not resulted in access to new markets or access to certified woodlands. Initially we though that bring a chain of custody certification logging contractor would allow us to purchase stumpage on certified lands. But certified landowners have generally not chosen to sell stumpage; rather they have begun marketing logs themselves, or in some cases "extending" certification to the contractor working on the property. By this time we have not yet sold any logs into certified markets. Please feel free to contact me with questions.
We don't have enough supply of certified wood - so, we don't have a good volume to answer the questionnaire.