Opportunities for the Utilization of Non-traditional Species in Wood-based Component Manufacturing

By

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Abstract

A mail survey of the US secondary wood products industry was conducted to assess the current species used and the market potential for the use of "non-traditional" species. Seven market segments within the secondary wood products industry were surveyed including the cabinet, flooring, millwork, office furniture, dimension and component, window and door, and household furniture market segments. Information from three hundred and fifty-seven was analyzed for this research.

The results indicate that the secondary wood products industry is using a majority of "traditional" species to manufacture their products. For the industry as a whole, oak was the most popular species, which included the use of both red and white oak. Red oak average board footage use was calculated to be 1.3 million per year in the secondary industry.

"Traditional" species for the component manufacturing segment were determined to be red oak, white oak, hard maple, cherry, ash, and soft maple. These species are being produced because of consumer demand. The component segment sells most of its products to the household furniture and cabinet market segment. Both of these markets are driven by fashion trends and what consumers view as "in-style." The component segment will be able to produce more "non-traditional" wood products when their

customers (i.e., the six other market segments that were surveyed) begin to make finished goods with these species.

Analysis showed that significant differences did exist between "non-traditional" species using companies and "traditional" companies on their ratings of component and component supplier attributes. Consistent supply was one attribute that was rated higher by many segments' "non-traditional" species users. The issue of supply will need to be addressed before many of these companies will be willing to use more "non-traditional" species. Within the overall secondary industry there was a significant difference between the importance that "traditional" species users placed on consistent supply and the importance that "non-traditional" species users placed on this attribute. "Non-traditional" species users were more concerned with having a consistent supply of their raw material and component products. For "non-traditional" species to be successful within the secondary wood products industry, a proven supply line must first be established.

There is a potential to use "non-traditional" species in all of the markets that were surveyed. The millwork segment displays the most potential. This market segment already uses a wide variety of wood species, which shows there is no dominate species that is desired. The office furniture market segment also displays potential for "non-traditional" species. This segment desires a low priced raw material and "non-traditional" species can fulfill that need.

Dedication

I am dedicating this study to my parents, Danny and Ellen McDaniel. Over the past twenty-four years they have shown me an astounding amount of support and love. Without their constant guidance throughout my college career, I would not have made it where I am today. I would like to take this opportunity to show my gratitude to them for their help in the past and the help I know they will continue to give me in the future.

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Preface

This thesis consists of five sections. Chapter One defines the problem, outlines the objectives of this research, and reviews the literature that deals with the secondary industry and the use of "non-traditional" species. The remainder of the thesis is divided into four sections that present the results of the research. Chapter Two discusses the overall secondary industry, which includes demographic information, material use, and production. Chapter Three discusses each of the seven market segments that were surveyed individually. This chapter displays information on demographics, material use, production, and the potential problems and solutions to the use of "non-traditional" species use within each market segment. Chapter Four discusses the use of different species within each of the seven market segments and where potential areas may exist for the use of "non-traditional" species. Chapter Five summarizes the results, provides the conclusions, and outlines the limitations to this study. Duplication exists throughout the thesis to allow for each section to stand-alone. The author apologizes for any inconvenience this may cause the reader.

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Chapter 1

Abstract

The wood-based component market segment has continued to grow in the past several years due to an increased usage of components by many secondary manufacturers of wood products. There has been a decrease of high value raw material available for the production of wood components. This decrease has caused many companies to look into using an alternative raw material supply. One option for this industry is to use non-traditional species, such as birch, aspen, gum, red maple, and softwoods in the manufacturing of components. This research was conducted to evaluate the barriers that may exist for both the component manufacturers and the users of these components. Some barriers that exist are consumer demand, supply of raw material, and not enough information on the species. A survey of wood component manufacturers was sent out, along with a separate survey to each secondary market segment, which included office furniture, household furniture, cabinets, millwork, dimension and components, windows and doors, and flooring. The information that was gained from this research was used to determine strategies for implementing the use of non-traditional species.

Introduction

The wood-based component market segment consists of manufacturers of dimension parts and edge-glued panels. These parts and panels are produced from sawn lumber and are used to manufacture products such as furniture, cabinets, building products, and flooring. Wood component parts are dried and processed to a point where the maximum waste is left at the mill, and the maximum utility is delivered to the customer (Vlosky, 1996). Wood-based components have become one of the main growth areas within the hardwood industry. Traditional component manufacturers produce parts to be sold to secondary manufacturers, who in turn use the parts to further manufacture cabinets, furniture, flooring, and building products. Until recently, the industry consisted of a large number of small, family-owned businesses. This trend is changing as larger companies enter the dimension market. Many sawmills are expanding into the dimension market to increase the value of their product offerings. Another reason larger companies are replacing the small "mom and pop" operations is the growing cost associated with capital investments required to operate a manufacturing facility successfully (Lawser, 1997).

In the last several years, the wood component market segment has begun to change in many ways. The largest change has happened in the species mix. The component segment continues to produce a large amount of red oak products, but red oak has lost ground to many other species, including hard maple and cherry. Other product changes have come in the form of more value-added products. The segment has become more specialized as the furniture and cabinet segments have begun to outsource more of their business. More sawmills are now producing cut-to-size blanks that are semi- or

fully-machined component parts (Lawser, 1997). The breakdown of total component sales has placed cut-to-size blanks in the top spot with 19.3% of the sales, with mouldings and edge-glued panels right behind with 16.5% and 13% of the market, respectively (1-WCMA, 2001).

The export market is also a growing market for the component segment. Every year there has been a rise in the number of companies, both US and foreign, that export wood components. The Wood Components Manufacturing Association (1-WCMA, 2001) reported that export sales represented an average of 27.7% of the total sales for an exporting company. This represents a considerable growth from the previous year when exporting only accounted for 18.7% (1-WCMA, 2001). This growth is due to an increase in Canadian companies exporting more of their products to the United States. The top exporting countries of dimension and component parts are the United Kingdom, United States, Canada, Germany, Scandinavia, France, Japan, and Belgium, in that order.

The outlook for the North American wood-based component segment looks good. Both the US and Canadian economies have experienced a slowdown, but continued growth is expected (1-WCMA, 2001). As these countries attempt to become more competitive with foreign manufacturers, one alternative is to use non-traditional species that are less expensive and under-utilized, such as birch, aspen, gum, red maple, and softwoods. These non-traditional species are found in much of North America. Little is known of the barriers that exist to using these species in the component market segment.

The component market segment continues to grow because there has been a rise in companies attempting to increase their profits by adding value at their mill site. Producing wood components can mean adding a considerable amount of value to the

forest resource. Many communities are attempting to add to their local economies by pursuing economic development initiatives to add value to their hardwood resources. A logical step for many sawmills is to move to the next step on the value-added chain by producing wood components and allowing them a way to diversify and increase profit margins (Vlosky, 1996).

Justification

The secondary wood products manufacturers are facing the problem of lower quality and higher priced raw materials. For the most commonly used species there has been a rise in cost for the desired material. Many lesser-used species or "non-traditional" species exist in the US and Canada in abundance. Much of this resource is going unused because currently there exists no demand for the material. Currently there is little information published on these species and on the perceptions of the use of these species in the secondary wood products industry. The use of "non-traditional" species could allow manufacturers to lower their raw material cost.

Research Objectives

The purpose of this study is to identify opportunities for the use of "non-traditional" species within the wood components market segment. In order to understand these opportunities it is vital to know why wood component manufacturers and wood component consuming segments use specific species and how they view the use of non-traditional species.

The specific research objectives are to:

1. estimate the percentage of "non-traditional" species used in the secondary industry;

2. identify wood component manufacturers' and component consuming market segments' perceptions on increased use of "non-traditional" wood species;

3. identify the differences between companies that use "non-traditional" species and those companies that do not; and

4. develop recommendations for using more "non-traditional" species in wood components manufacture.

Literature Review

Secondary Industry

In 2001, the primary hardwood industry produced 10.7 billion board feet (BBF) of hardwood lumber, while the domestic secondary industry's demand was about 12.8 billion board feet (Hardwood Review, 2001). The majority of the hardwood lumber is consumed by eight major markets: pallets, furniture, dimension, exports, millwork, flooring, cabinets, and railway ties (Hansen and West, 1998). Table 1 shows these major markets and their demand for hardwood lumber and also includes distribution yards.

Table 1.1: Lumber consumption by the secondary hardwood industry's markets.

	2001 (Billion Board Feet)
Lumber Production	10.7
Market Demand	
Furniture	2.0
Cabinets	0.7
Exports	1.1
Components and Moulding	1.4
Distribution Yards	1.4
Flooring incl. Trailer	1.0
Pallets/Containers	3.8
Railroads	0.8
Other	0.7
Total Demand	12.8

Source: Hardwood Review, June 2001.

Pallets and containers are the number one market for hardwood lumber, but this market segment is not expected to rise. The growth within the pallet market segment has leveled off and is expected to stay steady through 2005. The furniture market segment consumed a total of 2.0 BBF in 2001, but this number is expected to drop in 2002 to 1.8 BBF. This trend is expected to continue over the next several years due to an increase in manufacturing moving offshore. The wood component market segment is also expected to be affected because many manufacturers are moving their business offshore. There is expected to be a slight drop in the demand for components and kitchen cabinets.

The secondary industry uses a wide range of hardwood species and grades. In 1999, hardwood sawmills in the United States produced 34% red oak, 16% yellow poplar, 15.5% white oak, 8.8% hard maple, 5.9% soft maple, 4.7% black cherry, and the remainder of 15.1% was composed of a wide variety of other species (Bowe et al., 2000). These species are considered to be traditional species, because they have been commonly used in the past in wood manufacturing.

The US secondary hardwood industry is currently experiencing several raw material problems. The two main problems are the increasing cost of raw material and the declining availability of high-grade material. Sawmills have seen larger volumes of lower grade logs arrive at the sawmill, and these logs are yielding high amounts of undesirable and unmarketable lumber (Pohle, 2002). This problem may open the door for new species of wood to be utilized in order to fill the void where the higher grades of traditional species are lacking.

There is a good deal of motivation for secondary manufacturers to consider using different raw materials to produce their product. The price of hardwood lumber is

increasing, and there is becoming a very limited supply of high quality/high grade material. In the last 10 years, lumber prices have risen dramatically for the traditionally used species, such as cherry, red oak, and hard maple. These prices have risen as much as 130% from 1990 to 2001 (Meeks, 2001). It is becoming very difficult for most manufacturing operations to find sufficient supplies of desired raw material. This is due to changes in the hardwood timber resources and an increasing export of hardwood lumber. Hardwood raw materials suffer from decreasing size of log diameter and a decline in log quality. As this trend continues, more lower grade lumber will be produced (Meyer, 1996). A viable option for many manufacturers who do not want to use lower grade lumber is to look into using non-traditional species in place of many of the "normal" hardwoods they currently use.

Dimension and Component Products

Historically, hardwood components were manufactured by an segment known as the "hardwood dimension market segment." The term "hardwood dimension" reflected the fact that the market segment's products were smaller boards cut to specific lengths, widths, and thicknesses. More recently, however, the term "hardwood component" is replacing "hardwood dimension" to describe this market segment and its products (qtd. in Haas and Smith, 1997). Component products are described as cut-to-size blanks; edge-glued panels; dowels; solid and laminated squares; turnings; moldings; furniture parts; upholstered frame stock; staircase parts; millwork; flooring; cabinet doors; and cabinet parts (2-WCMA, 2001). In general, dimension parts are dried and manufactured so that the maximum waste can be left at the dimension mill. The dimension product is produced from lumber, bolts, cants, or logs to the requirements of the customer. These

products come in the form of solid pieces or glued pieces and can be either rough, semi-, or fully-machined depending on the customer's specifications. The rough dimension parts are blanks that have been cut to a certain size and shape. The semi-machined dimension part is processed one step further; either surfaced, moulded, turned, or otherwise manufactured without making the product a completely machined product ready for assembly. Fully-machined products are completely machined and ready for assembly with no further work necessary.

Information on the dimension segment is lacking, even though component producers play a large role in the valued-added chain of wood manufacturing. Hardwood components represent a great opportunity for companies to capture more value out of their product. By producing wood components US manufacturers would utilize more labor and this would encourage a larger amount of investments in new technologies to manufacture these goods (Haas and Smith, 1997).

The Wood Components Manufacturers Association (WCMA) represents manufacturers of wood component products made from various hardwoods, softwoods, plywood and engineered wood materials. The association was first formed in 1929 as the Hardwood Dimension Manufacturers Association (HDMA). The WCMA has since changed its name twice to better incorporate and reflect its growing membership base. Today the WCMA has member companies of many shapes and sizes from all across North America. The association maintains the "Rules and Specifications for Dimension and Woodwork" as the standard rules for the wood dimension and component products segment (2-WCMA 2001). These rules provide specific standards regarding seasoning, gluing, tempering, workmanship, and thickness for all three categories (Anonymous

1998). The WCMA has several objectives that include promoting a friendly exchange of ideas among those engaged in the manufacturing of dimension and component products; promote demand for the segment's products; collect and distribute useful information concerning the segment; respond to inquiries from dimension and component buyers and passing this information onto members; continuing education within the market segment; maintain standard rules and specifications for the segment; collaborate with other wood products trade associations and appropriate government agencies to promote and protect the interest of the market segment (2-WCMA, 2001).

In 2001, cut-to-size blanks represented the largest product category of total dimension sales, followed by mouldings and edge-glued panels (1-WCMA, 2001). In 1997, roughly 66% of the dimension products produced in the United States were considered to be fully- or semi-machined component parts (Lawser, 1997). Most hardwood dimension is sold to the furniture, cabinet, and building products market segment (moulding, millwork, staircases). A considerable amount is also used in a variety of other decorative wood products (Anonymous, 1994).

Markets for Dimension and Component Products

Wood Furniture

The wood furniture market segment is described by SIC 2511 (wood household furniture except upholstered), SIC 2512 (upholstered household furniture), and SIC 2521 (wood office furniture). Under the new "North American Industry Classification System," which replaced the SIC system in 1997, the wood furniture market segment is described by NAICS 337122 (non-upholstered household furniture manufacturer) and NAICS 337211 (wood office furniture manufacturer).

The "Annual Survey of Manufacturers" published by the US Census Bureau (US Census Bureau, 2002) states that the non-upholstered wood household furniture market segment in 2000 shipped goods with a total value of roughly $13 billion. Upholstered household furniture manufacturers shipped about $9.8 billion worth of goods, while the wood office furniture manufacturers shipped approximately $4 billion worth. The raw material costs used to produce this furniture account for roughly $6 billion in the non-upholstered wood furniture market segment and for about $ 5 billion in the upholstered furniture segment. The wood office furniture manufacturers used raw material valued at approximately $1.8 billion.

In 1993, the furniture segment consumed roughly 254 million board feet of dimension parts and 1.8 million board feet of hardwood lumber. From 1993 to 1995, the use of dimension parts was predicted to increase by about 14% to 288.6 million board feet in 1995, while lumber use was expected to rise by 15% (Hansen et al., 1995). This indicates a decrease in the use of dimension lumber, but in 1997, about 50% of the lumber that was used to produce furniture was dimension (Hansen and West, 1998), which indicates that there was actually an increase of dimension lumber utilization.

A growing scarcity of high quality hardwoods is making it more difficult to produce quality solid wood furniture at an affordable price. This problem is causing the segment to look for alternatives to solid hardwoods. The use of composite wood products is one way the furniture segment is looking to create the appearance, feel, and structure of solid wood while manufacturing a reasonably priced product. Laminated veneer lumber (LVL) is one composite product that has potential value for the furniture market segment. LVL is produced by gluing together sheets of relatively thick veneer

with the grain of all plies running in the same direction. This technology allows the manufacturers of LVL to place any defects in the veneer in the inner layers of the LVL. This creates the appearance of a defect-free piece of hardwood lumber (Eckelman, 1993). Placing a sheet of veneer on composite products and lower grade hardwood lumber offers the benefit of using lumber that would otherwise not be incorporated into a piece of wood furniture.

Office furniture demand is driven most decisively by the employment growth in office-intensive industries. Due to poor profits, virtually all hiring has come to a stop. Since the second quarter of 2001, overall employment rates in the US have been negative. This trend, however, is predicted to stop. Predictions indicate that employment will slowly rise in 2002 and 2003 (Anonymous, 2002). This potential growth opens the opportunity for many furniture manufacturers to introduce new products. Business and office furniture manufacturers are beginning to look for products to produce other than their traditional lines of furniture. One of the changes taking place is the move to add ready-to-assemble (RTA) lines and office furniture aimed at use in homes. Designing and producing office furniture now calls for creating cost-effective, flexible and adaptable work environments that serve as places for high productivity (Reardon, 2001).

The residential furniture sector has had a slowdown in 2000 and 2001 with shipments in 2001 at $26.3 billion. The growth of the segment has slowed from large growth rates in the late 90's, which have been close to 10% each year. In 2001, the growth rate was only 2.1%, but this rate is predicted to grow in the coming years with an increase in growth of 3.4% in 2002. Some of the trends that will help the residential furniture segment grow are the move to do more work from home and spend more money

on furniture just for children. Working from home has been made easier with the continual growth of the personal computer and internet. By allowing more work to be done from home, many people will be willing to purchase office furniture for this change in lifestyle (Brackett, 2001).

The American Furniture Manufacturers Association (AFMA) is predicting growth in both the upholstered and non-upholstered furniture market. The AFMA is predicting a 3.1% growth for the entire market segment in 2002 and an even larger growth, 4.8%, in 2003. Upholstered furniture is expected to recover from the 2001 slowdown faster than solid wood furniture. Some reasons for this expectation are that upholstered furniture is slightly more affordable and offers consumers a way to "freshen up" their homes (Furniture Today, 2002). At home, America is focused on relaxing, says Jeb Bassett, President of Wood Manufacturing at Bassett Furniture. This means, for the furniture market segment, that people are looking to purchase more casual looking furniture, which tends to be upholstered. Many products that still have wooden parts showing are using species with a lighter color, whereas dark formal woods, such as mahogany and walnut, are becoming less popular (Steenbergen, 2002). This market for upholstered furniture and lighter colored solid wood furniture could be a great market for lesser used hardwoods and softwoods.

The US furniture market segment continues to become more and more dependent on furniture imports. Since the labor cost in Asia and other foreign countries is very low, the US hardwood industry has been able to ship lumber to Asia for them to produce furniture and sell the furniture back to the US consumers at a lower price than if manufactured in the US. The Asian manufacturers have begun to notice that US

consumers have showed little brand or species loyalty. This trend has allowed the Asian manufacturers to ship low-priced furniture to the US using smaller quantities of US hardwoods (Luppold, 2002). The main way the US furniture market segment is able to compete with cheaper Asian furniture is through the advantage they have in the distribution channels.

Many experts in the past have believed that the US furniture segment would be able to thrive because of the timber resource that exists. What they have missed is that it only takes a small land mass, about the size of West Virginia, to produce all the timber (on a sustained basis) to supply our export lumber market. It is not the large resource in which US manufacturers have the competitive advantage, but the efficient lumber distribution system afforded by this timber base. When international competitors are able to find alternative "efficient" lumber distribution systems, then the US dollar will determine whether international buyers receive lumber from the US or other sources (Luppold, 2002). The amount of furniture imports from Asia and other countries has continued to rise and has hurt many American furniture manufacturers. In 1990, the percentage of foreign furniture shipments to the US was approximately 21%. In 2000, imports to the US were estimated to be upwards of 45% (Raymond, 2002).

Cabinet Market segment

The US wood cabinet market segment is described by SIC 2434 (wood kitchen cabinets) and SIC 2517 (wood TV and radio cabinets). With the newer "North American Industry Classification System," it is described by NAICS 337110 (wood kitchen cabinet and counter top manufacturer) and NAICS 337129 (wood television, radio, and sewing machine cabinet manufacturer).

In general, three types of cabinets can be distinguished: custom cabinets, semi-custom cabinets, and stock cabinets. Custom cabinets are made according to customer specification based on individual orders. Stock cabinets are produced in larger quantities and are only available in standard sizes. Semi-custom cabinets are a combination of the two other categories, allowing more sizes than stock cabinets but not offering the total customization of the product (qtd. in Olah, 2000).

It was estimated in 1999 that the total lumber use for the cabinet market segment was 843 million board feet. The use of hardwood lumber, excluding dimension, was approximately 484 million board feet. An increase of 16% to 562.7 million board feet was predicted for 2001. The use of parts and components was estimated in 2001 to be 68.3 million cabinet doors, 26.3 million board feet of edge-glued panels and cut-to-size blanks, and 31.8 million board feet of other cabinet parts. This use of components and parts is roughly 215 million board feet (Olah, 2000). Olah (2000) estimated that about 358 million board feet of hardwood lumber was used to produce these 215 million board feet, adding up to the total lumber use in the cabinet market segment of 843 million board feet. For 2000, the average annual lumber throughput for a cabinet manufacturer was estimated to be 1.3 million board feet (Cumbo, et al. 2001).

The US cabinet market segment uses a wide range of species. Design trends reflect a continuing expansion of décor and functional options. Cabinetmakers continue to diversify and offer more choices to the customers on what type of style, material, and finish they would like. Kitchen Cabinet Manufacturers Association's (KCMA) Executive Vice President Dick Titus says, "Consumers continue to favor lighter finishes and distinctive fashion colors." At one point, oak dominated the cabinet market with over

75% of the species mix, but has since given way to smooth grains, which include cherry, maple, and hickory (Titus, 2001). In 1990, the dominant species was red oak, which held a 49% share of the market. It was followed by white oak, hard maple, and yellow poplar, which had 9%, 5%, and 4% of the market respectively. The rest of the market was comprised of many different species of minor importance (Bush, Sinclair, and Araman, 1990). Punches (1993) found that in 1991 red oak was even higher in importance: 63.9% of the lumber used for cabinet production was red oak, followed by hard maple (8.3%), cherry (4.3%), and birch (3.9%). Other imported and domestic species were also used in small percentages. Hansen et al. (1995) found in 1993, numbers that resembled the findings of the KCMA. Hansen showed that 74.7% of the lumber used by the stock cabinet segment was red oak. Hard maple accounted for 10.3%, followed by cherry with 3.7%, and alder with 1.9%. The remainder is imported and other species (Hansen et al., 1995). In 1999, the dominant species was still red oak (44%), but its importance had decreased. This was followed by hard maple (24%), cherry (10%), soft maple, and ash (5% each). Hickory, poplar, white oak, alder, birch, and other account for the remainder of the species used (Olah, 2000).

The Canadian cabinet market segment, in 1999, had shown significant growth from previous years. Much of this growth was due to the increased amount of exporting Canadian manufacturers were participating in. In 1988, Canada was only exporting $38.8 million in kitchen cabinets, compared to 1999 when exports topped out at $586 million. The growth in just the past few years has been phenomenal, with a growth of 25.4% between 1998 and 1999. The US continues to be the primary export destination

for kitchen cabinets made in Canada. In fact, almost all kitchen cabinet exports (99.1%) were shipped to the US, with a value of $575 million (Anonymous, 2000).

Outsourcing is becoming a major part of the cabinet segment. Many cabinet companies are being faced with conditions that make counting each penny the only way to be profitable. Most cabinet manufacturers have, for years, made their own parts, and they have always used the thought process that there is no reason to pay someone to do something you can do yourself. Now, outsourcing many parts has become a trend. Reasons outsourcing can help these companies include time, money savings, and the most important factor to most, the elimination of many of the company's variable costs. When companies purchase parts from component manufacturers, they know the exact cost of the product, which means managers no longer need to be concerned with waste and overhead costs. Outsourcing also enables many cabinet manufacturers to produce products they would otherwise be unable to produce because of equipment limitations. A company who chooses to outsource is able to then concentrate on the strengths of the company. A custom cabinet manufacturer that specializes in architectural millwork may save a lot of time by purchasing drawers and other parts from component producers, thus allowing for the company to sell more cabinets and expand their existing business. Outsourcing continues to grow in popularity around the cabinet segment, making many companies more profitable (Donlin, 2000).

Building Products: Millwork and Windows and Doors

The millwork market segment consists of those companies that manufacture doors and windows, stair parts, blinds, mouldings, and assorted trim. The SIC code that would incorporate much of the millwork market segment would be 2431 (millwork), or under

the new "North American Industry Classification System," which replaced the SIC system in 1997, millwork is listed in a number of categories that can include flooring and wood windows and doors, so for the purpose of our study we will not try to place millwork in just one of these many NAICS categories. Currently, approximately 75% of mouldings and millwork are made from softwoods, while 25% are made from hardwoods. The predominant softwood species include ponderosa pine, Douglas fir, southern pine, true firs, and eastern white pine. Red oak and, increasingly, yellow poplar are the primary hardwoods used in this market. It was estimated in 1990 that nearly one billion board feet of lumber was used in the millwork and moulding market segment.

Wood windows and doors are listed by the SIC code 2431 and is incorporated with millwork, but under the NAICS these products are listed separate from millwork under the code 321911. According to the "Annual Survey of Manufacturers" the market segment shipped goods that totaled over $10.8 billion (US Census Bureau, 2002). The wood window and door segment is highly linked to the new construction and remodeling sectors. In 1992, 60% of wood doors and 63% of wood windows were sold to residential repair and remodeling projects (Lee and Greber, 1996). With the recent slowdown in the economy we are seeing a decrease in the amount of housing starts across the country. This slowdown of construction will cause the window and door segment to have reductions in volumes and increased competition for business. Alan Campbell of the Window and Door Manufacturers Association (WDMA) believes that the past several years of strong growth, technological advancements, and aggressive marketing campaigns have laid down a foundation that will allow the market segment to "wait out' this current economic cycle (Campbell, 2001).

One change the window and door market segment has seen is a gradual change in material. The market segment has seen a significant increase in vinyl products, along with a growth in demand for wood/non-wood composite material (Campbell, 2001). Other issues facing this segment include labor and energy concerns. Campbell states that labor is always a major issue, but as the economy has slowed down there has been a positive effect on labor availability (Campbell, 2001).

The architectural woodwork and store fixture segment of this market has had a significant slowdown during this soft economy. However, most of the companies that responded to the "Wood and Wood Products 15th Annual State of Architectural Woodworking and Store Fixture Industries Survey" showed some optimism for the future. The tepid optimism is a slight improvement over the previous year's result (Sypkens and Landgraf, 2002). This survey also sought to verify the segment's top concerns. The main concerns for this segment showed to be the economy, workforce, competition (both domestic and foreign), and slow payments (Sypkens and Landgraf, 2002). When reviewing this market segment, we find that none of the respondents listed a short supply of high-grade material as a concern nor were they concerned that they were running low on their desired species of wood.

Flooring

The US wood flooring market segment is described together with the hardwood dimension market segment by SIC 2426 (hardwood dimension and flooring mills). Under the new "North American Industry Classification System, it is described by NAICS 321918 (other millwork (including flooring)).

The hardwood flooring market segment shipped goods that totaled $1.4 billion in 2000, according to the US Census Survey of Manufacturers (2002). This figure has increased from the previous three years. This increase in hardwood flooring can be attributed to a number of reasons. Hardwood floors have become "in style" and many homeowners are replacing their old carpet and vinyl floor coverings with wood flooring. Wood flooring has also become popular because of the reduced maintenance and health problems associated with carpet. Many people suffer from allergies, and one way to reduce the pollen, dust, and dander around the home is to remove carpet, which can trap many of these allergens. Hardwood floors are also easier to clean and maintain. Wood flooring does not show the stress that carpet does in "high traffic areas," which means it does not need to be replaced as often. The wood flooring also offers the homeowner versatility. If the owner decides that having a padded surface is desired then the placement of a rug can fulfill this need. This allows the owner to change the room's design and look more often by changing the rug or removing it all together.

The US wood flooring segment produces several types of hardwood flooring, which can be grouped into two categories: solid hardwood flooring and engineered flooring. The first is made from a solid piece of hardwood lumber; the second consists of several plies of hardwood or softwood veneer, covered with a hardwood face veneer (qtd. in Alt, 2001). The solid hardwood flooring is further divided into strip, plank, and parquet flooring. The majority of all flooring produced is strip flooring, a solid piece of wood produced in a tongue and groove pattern with widths ranging from 1.5 inches up to 3.25 inches. Plank flooring is also produced with a tongue and groove pattern, but its width varies from 3 to 9 inches. Parquet flooring is designed to form flooring patterns

and is thereby often manufactured in short lengths of individual pieces. It is usually also produced with tongue and groove and end-matched features.

Solid wood flooring is sold in different qualities, allowing different amounts of character-marks to be included in the finished product. The highest grade in each group will be practically defect-free with a very uniform appearance. The lower the grade, the more color variations and characters like sapwood, streaks, small knots, or worm holes are allowed to make the grade. The grades vary with the species used. For oak, ash, cherry, and walnut the highest flooring grade is "Clear Oak/Ash/Cherry/Walnut," followed by "Select Oak/Ash/Cherry/Walnut," "No. 1 Common Oak/Ash Cherry/Walnut," and "No. 2 Oak/Ash/Cherry/Walnut." For beech, birch, hard maple, hickory, and pecan the general flooring grades are "First Grade," "Second Grade," and "Third Grade." There are also two quality classes that combine grades developing from the production run: "Second and Better Grade" and "Third and Better Grade." A variety of special grades exist allowing for particular features of single wood species (NOFMA, 1999).

There are many engineered flooring systems that are made from wood composite materials. Placing a veneer cover over a product such as LVL, OSB, or plywood produces some of these engineered floors. Engineered flooring is manufactured to look like strip or plank flooring, only in larger widths and lengths. Since it consists of several layers, the core layers cannot be seen in the finished product. This allows using a higher amount of lower grade material in the substrate layer (Smith and Lamb, 1997). The "National Oak Flooring Manufacturers Association" (NOFMA) defines quality rules only

for oak. The grades are "Select and Better Engineered – Oak," "No. 1 Common Engineered – Oak," and "No. 2 Common Engineered – Oak" (NOFMA, 1999).

In 1999, engineered flooring accounted for 39% of the hardwood flooring market; solid hardwood flooring took 61% of the market share (qtd. in Alt, 2001). Helm (2000) found that engineered flooring was the fastest growing segment among all types of hardwood flooring, mainly because it is easy to install.

Outsourcing

Outsourcing has become very popular over the past few years in a number of wood-based manufacturing companies. Some of the main reasons a company may outsource many of its parts is simple: To save time and money. But for many companies the most important reason to outsource is to eliminate the variable cost associated with making their component parts (Donlin, 2000). Outsourcing involves the purchase of parts or finished goods from outside companies. By doing this the secondary manufacturing company can then have an exact cost associated with that particular part. WCMA research revealed that furniture and cabinet manufactures can increase their profitability by outsourcing (Lawser, 1998).

Outsourcing is said to open a "Garden of Eden" for furniture manufacturers and suppliers (qtd. in Imberman, 1999). Every furniture and cabinet company is being urged to outsource as many of their components as possible. The question raised to many of these companies is how much do we outsource, and how much do we continue to manufacture in house? Outsourcing has been popularized in today's wood manufacturing business because it allows a company to focus on its core business and get back to doing what that company does best. With this new outsourcing, estimates indicated that 20 –

22% of value-added furniture and fixture production is outsourced (Imberman, 1999). Some companies have gone as far as to shut down most of their production facilities and outsource all of their manufacturing, leaving behind only their administration and marketing departments. This type of outsourcing is probably not going to be seen in the wood products industry anytime soon, but it is a growing trend (Imberman, 1999).

Many major US furniture companies are now purchasing finished or semi-finished products from Asia. Many of these companies purchase parts from foreign businesses, but some are even locating part of their own operations overseas to reduce cost. This shift in overseas purchasing is affecting every corner of the home furnishings market segment – design, marketing, manufacturing, distribution, and retailing. Operational, legal, and financial issues have all been brought to the forefront for many of these companies attempting to increase their business by outsourcing overseas (Aves, 2001). The WCMA has conducted many "make vs. buy" studies targeted at component buyers. The surveys are done to assess the potential advantages to purchasing components from North American suppliers. Steve Lawser at the Carolina's Industrial Woodworking Expo Seminar presented the list of the major advantages (Lawser, 2002). He listed advantages that included faster response time, just-in-time deliveries, ability to fill smaller orders, reduce inventories, better communications, consistent quality, wider species selection, and sustainable forest resources. Some strategies were also given to the component companies in hope of raising their domestic business. Mr. Lawser pointed out that the companies should know their cost and focus on cost reduction. The WCMA has developed a manual for their members to use so they may compare costs and identify areas of improvement.

The second strategy was to improve production efficiencies and labor production. One area where improvements could be made was using modern woodworking machinery that could help with lumber drying, yield improvement, materials handling, and producing precision components. North American companies were told that they must strive to produce more with fewer workers to keep up with the competition from China, Asia, Eastern Europe, and South America where labor is cheap. The last strategy that Mr. Lawser gave was to improve the marketing and sales of the company: use marketing to help highlight the advantages of using North American component parts (Lawser, 2002).

Distribution of outsourced parts can be a major determining factor for companies looking into purchasing component parts. Having the part you need when you need it is very important within many of the wood products secondary industries. Most wood products companies are reducing their warehouse sizes and expect just-in-time (JIT) delivery from their suppliers. This demand for quick and reliable distribution is an advantage for North American suppliers. One downside to outsourcing overseas is a lag time in shipping. Also, if there is a problem with the order it is much easier for companies in North America to remedy the problem and make sure the secondary manufacturer continues operation with the correct parts. Another problem that arises with purchasing parts from overseas is the indirect communication between companies. Communication may be difficult because of language barriers and time differences.

Companies wanting to outsource may often want to send a representative to the component manufacturing company to see the operation and to personally visit with the salesperson or staff. When outsourcing parts overseas, traveling to the mill site may be

impossible because of time and money constraints. North American companies need to highlight these advantages when selling to other North American companies. Knowing how to sell these advantages to secondary producers can be the difference in whether or not a component manufacture is able to "survive" producing products using North American hardwoods.

Barriers

There has been little published about the why "non-traditional" species of wood are not used more often in the manufacturing of wood-based component products. Most manufacturers produce a product that has been ordered from their consuming market segment, such as furniture, cabinets, millwork, and others. The main barrier to using different species will be to get these manufacturers to produce products that use non-traditional species. While little has been published on using different species within these market segments, a few studies have evaluated the use of low-grade and character-marked lumber. Most of the barriers that exist for these two issues also exist when trying to introduce new species.

The furniture market is driven mainly on fashion and style. Kron (1983) claims that standards of taste and style in furniture are primarily determined by what appears in home furnishing magazines. Retail buyers and consumers often take cues from such magazines in their subsequent purchases. Bumgardner et al. (1999) added to Kron's work by suggesting that manufacturers often take cues from secondary sources for new product ideas as well. Bumgardner's studies have focused on using character-marked lumber in the production of wood furniture. Many of the barriers that he found may also

be problems that will exist to introducing new species in the production of furniture and other wood products.

Market segment magazines of home furnishings and decorating can help increase the awareness of new products on the market. These magazines have the ability to shape trends and fashions for new and existing products. If editors of home furnishing magazines were encouraged to increase exposure of furniture that used character-marks or new species, the change of fashion in hardwood furniture might gain wider acceptance in all segments of the distribution chain (Bumgardner et al., 1999). Many manufacturers could be persuaded to try new species in many of their new products at the beginning of the design and development phase.

Many of the wood market segments that are fashion-oriented have developed a risk-averse orientation that dissuades them from creating innovative new products (Hatch, 1980). In these market segments designers play an important role in shaping fashion trends, therefore driving sales. There are several examples of manufacturers who have taken a risk by designing and introducing a new product, which has been met by initial resistance, but ultimately set the stage for an market segment design change (Martin, 1995). This could be the case for the furniture or cabinet market segment if they decided to release a product that consisted of non-traditional species, but most companies are not willing to wait for the consumer's taste to change.

Solomon (1988) and Kron (1983) point out that most product design is done prior to any consumer involvement. Most designs are slowly "weeded out" before consumers ever see the final product. This means that the consumer has no say in the raw material being used to manufacture the product. The product designs must go through designers,

retail buyers, editors of style magazines, manufacturers, and advertisers. These people serve as gatekeepers who decide what product choices consumers will ultimately make. Often, this system can lead to a high degree of convergence on the underlying design themes of products (Bumgardner et al., 2000).

Retailers are a very important step in the market segments' distribution chains. It is the retailer that will either accept or decline new designs of products by their purchase decisions. If the retailers do not accept the new design then the product will never reach the consumer. The furniture market segment has traditionally been viewed as a "push" segment, where personal selling efforts by retailers will influence consumers purchasing decisions (Bennington, 1985).

A barrier that also exists is one of reactive instead of proactive firms within the forest products industry. Firms employing a proactive strategy prepare by allocating resources to preempt undesirable events, whereas reactive firms simply wait around until a problem develops and then attempt to deal with it (Urban and Hauser, 1980). Since much of the industry takes a reactive approach by imitating its competitors it may be difficult to entice these firms to use a new raw material. However, there is room for more proactive design strategy within the industry. The direct competition imposed by furniture markets puts pressure on manufacturers to have something new to offer and attract attention among the wide array of competitive offerings (Sinclair, 1992). It might be expected that if enough proactive companies were to introduce and have some success with products using non-traditional species that many of the reactive companies may begin to follow suit.

Bumgardner et al. (1999) found that companies who had success with manufacturing and selling character-marketed hardwood furniture lines experienced a "learning curve." This learning curve involved both manufacturing and marketing considerations. Some of these companies reported that character-marks were eventually dropped from many of the companies' lines of furniture. Companies that did exhibit some success displayed a degree of patience, giving the product a chance to be accepted when met with initial resistance by retailers or consumers. This degree of patience is what the industry will need if the introduction of new products made with non-traditional species is to be successful. The change to non-traditional species will not be an "overnight" success, but instead will gradually be accepted in the marketplace.

There have also been a number of studies done in an attempt to find markets for lower grade lumber. Many of the barriers that are faced in the use of low-grade lumber also exist when trying to introduce new species into the market. Using high-grade lumber has its advantages, such as the relative ease with which larger pieces of clear material can be obtained (Gatchell, 1987). Many sawmills would not want to waste their time and energy attempting to use lower grades of logs and lumber to produce an inferior product. In order for a sawmill to obtain the same yield from the lower grades of lumber that they currently obtain from higher grades, an increased machine time is required due to decreasing yield with decreasing lumber grade (Gatchell et al. 1999). This desire of sawmills to cut high-grade lumber can be viewed as an advantage for introducing non-traditional species. Since log quality of traditional species has decreased this can be an opening for companies to use other species and utilize the highest quality logs from the non-traditional species.

As of now the National Hardwood Lumber Association (NHLA) does not have grading criteria for all species of wood. Since no grading rules exist it would be up to the company to create a separate grading system for its product. Northwest Hardwoods, located in Portland, OR, found that NHLA's grading rules did not encompass their total product line so they developed their own. The NHLA's four main grading groups were further sub-divided and the group names changed to better-fit Northwest Hardwoods' product.

- Select and Better was changed to Superior.
- #1 Shop grade was divided into 2 products: Cabinet and Custom Shop.
- Custom Jacket Boards, Jacket Boards or Strips grouped excessively narrow boards and differentiated their yield.
- #2 Shop and #3 Shop were graded for yield, defect character, structural stability and separated into products for the upholstered furniture frame segment.

  As a result of this grading switch Northwest Hardwoods has turned NHLA's four grading brackets into nine separate brackets.

- Superiors
- Cabinet
- Custom Jacket Board
- Jacket Board
- Custom Shop
- Com/#2
- Premium Frame

- Standard Frame
- Eco/#3

Northwest Hardwoods has also set up their web page so that a perspective buyer is able to select a specific species, and information on that species is quickly available, such as machining, nailing, gluing, screwing and finishing (Northwest Hardwoods, 2002). This type of ingenuity could allow for a company to produce component products using non-traditional species by stepping outside of the NHLA's grading system and creating a unique system that best fits their needs.

Machineability and yield are two very import aspects of efficient production of marketable lumber and components. Most forest products companies have a very small profit margin, which means that they must produce as much product as possible from their raw material. Since little is known about how "non-traditional" species perform in the sawmill, many companies are wary of trying any new species. Some work has been done to show that low-grade lumber can be used and that improvements in yield can be made with the inclusion of character-marks. Yet, many sawmills are reluctant to begin producing this character-marked hardwood even with yield improvements. It is yet to be seen if manufacturers will produce and market products with character-marks and if retailers will be willing to purchase and sell the products (Bumgardner et al., 2000). This same scenario can be said for the use of non-traditional species. Even if it is shown that these species can be sawn and machined with high yield results, the product still must be sold to manufacturers before any money will be made.

Methodology

For this research, a mail survey was used to collect data. The questionnaires were designed based on the study objectives. The first Objective was to estimate the percentage of "non-traditional" species used in the secondary industry. Objective #2 was to identify wood component manufacturers' and component consuming market segments' perception on increased use of "non-traditional" wood species. The nature of Objective #3 was to identify the differences between companies that use "non-traditional" species and those companies that do not. Data was collected via a mail survey of wood component users (wood flooring, cabinets, millwork, wood office furniture, wood household furniture, and wood windows and doors) and a survey of component manufacturers. A mail survey was chosen for this research because of the sample size and the length of the questionnaire. The questionnaire was designed to gather information specific to each of the individual market segments. The questions were designed to collect information regarding alternative species utilization, potential markets, demographic information, equipment and technology currently used, and raw material characteristics that each segment desires. Alternative or "non-traditional species are defined for this study as being less than 5% of the market segments species mix. The bulk of the questions focused on determining what type of raw material is currently in use and the desired attributes of this material. The questionnaire was designed to be three pages in length. This length is desired to achieve a higher return rate. Members of the faculty at Virginia Polytechnic Institute and State University reviewed the questionnaire. A preliminary questionnaire was then faxed to at least three companies within each

market segment for a pretest. Final adjustments were made following the pretest and the first mailing of the revised questionnaire was mailed to 2,668 companies in January 2003.

Objective #4 was to develop recommendations for using "non-traditional" species in wood components manufacture. The data collected to fill Objectives 1, 2, and 3 was used to develop possible recommendations for using non-traditional wood species in wood component manufacturing. The recommendations developed will help show how wood component users can use and market products made with alternative species. The strategies will also help producers and consumers work together to become more profitable using non-traditional species.

Sample Development

The population of interest in this research was companies that manufactured or consumed wood components with twenty or more employees. The market segments that were surveyed were: hardwood dimension (SIC 2426), wood household furniture expect upholstered (SIC 2511), wood office furniture (SIC 2521), millwork and windows and doors (SIC 2431), wood kitchen cabinets and TV and radio cabinets (SIC 2517 and SIC 2434), and flooring (SIC 2426). The address list for this study was compiled by using two different sources. The majority of the list came from the American Business Disc 2002 (Info USA, 2002). The mailing list for the flooring segment was one that the Center for Forest Products Marketing and Management identified from a previous study. After all the company information was gathered, it was sorted by the company's listed primary line of business into seven different segments (cabinets, flooring, millwork, office furniture, dimension and components, windows and doors, and household furniture). Table 1.2 shows the number of questionnaires mailed to each segment.

Table 1.2: Sample frame by market segment

Market Segment	# of Companies (20 or more employees)
Cabinets	437
Flooring	198
Millwork	522
Office Furniture	247
Dimension and Components	428
Windows and Doors	494
Household Furniture	357
Total	2668

Ballenger and McCune (1990) stated that when sampling multiple populations for parameter studies, the following equation can be used to determine the correct sample size. The equation derives the sample size by using a question that will have the highest possible variance. For this questionnaire, the question considered to have the highest variance will be one that uses a Likert type rating scale from 1 to 7. The proposed equation is as follows:

$$n = [(Z_{\alpha/2}) ^2 (\sigma) ^2] / h^2$$

where: n = sample size
$Z_{\alpha/2}$ = reliability coefficient
σ = estimated population standard deviation
h = allowable tolerance level

A confidence interval of 95% will be used for this study. The variables and calculation are as follows:

$Z_{\alpha/2} = 1.96$
σ = (max value – min value)/6 = (7 – 1)/6 = 1
h = ± 0.2 for α =.05

$n = [(1.96)^2 (1)^2] / (0.2)^2 = 96.04$ rounded to 97

This equation shows that approximately 100 questionnaires needed to be returned from each of the targeted market segments to have a 95% confidence level. Since our desired response rate was 20%, at least 500 questionnaires were needed to be mailed to each market segments.

Questionnaire Outline

One questionnaire (Appendix A) for each segment was developed and mailed to each company within the sample population. Each of the questionnaires contained five sections; product type, raw material use, processing technology, company demographics, and open discussion questions regarding "non-traditional" species. This design allowed us to receive qualifying information within the first few questions, then company specific information, and conclude with two open ended questions that would allow for the respondents to voice their opinion on the use of "non-traditional" species.

The section of the questionnaire that dealt with raw material use was created in order to understand what materials each of the companies were currently using. This included questions that dealt with species use, along with questions that covered the grade and the amounts of each type of material. The respondent was asked to estimate the amount of each type of material they were using by comparison to other material using a percentage scale. There were 17 attributes listed where the respondent was asked to rate the importance of each attribute on a 7-point scale. The attributes that were listed were deemed important to the potential of using alternative raw materials, such as "non-traditional" species.

The processing technology section had questions that allowed respondents to identify their new technology (within the last five years). This section also had questions

that dealt with the role the Internet played within their company. Three questions covered the topic of production scheduling.

The demographic section collected information such as, company size, association membership, amount of sales, and number of employees to be used to help identify potential markets for "non-traditional" species. The questionnaire ended with two open-ended questions that allowed for the respondents to voice their opinions on the issues that are being addressed within this study. Before the data was analyzed all responses were coded and entered into an SPSS (SPSS, 2003) spreadsheet. The SPSS statistical software program was used to statistically analyze the data. Both Microsoft Excel and Word were used to record data that could not be coded and statistically analyzed.

Data Analysis

Descriptive information on the participant's company was gathered. Questions were asked regarding the type of product the company was producing, type of raw material used, outsourcing, certification, production scheduling, and demographic information.

A specific question gathered information on what major factors participants consider when choosing a species to use. Their options were *cost*, *ease of use*, *customer demand*, *supply*, and *other*. This type of question, resulting in categorical data, was analyzed using descriptive statistics. Frequency tables were produced to compare the relative importance of each factor within the specific segment.

Questions also asked participants to rate a list of attributes, *low price*, *price stability*, *on-time delivery*, *consistent supply*, and *service* on their importance to the

purchase of wood components. The rating scale was listed from 1 to 7 (1 = not important, 7 = most important). This type of question was analyzed using both descriptive statistics and analysis of variance (ANOVA) to test for significant differences among the market segments. Testing was done at the .05 level of significance. Due to sample size non-parametric testing (Kruskall Wallis) was also used to confirm the analysis of variance.

For all seven market segments species use estimations were calculated by applying each respondents species percentage use to its total lumber use. The calculated board feet for each species was then totaled and divided by the total lumber used to again give an estimate of the percentage of each species being used. These calculations were done for each segment individually and for the overall secondary industry.

Questions dealing with barriers and other issues of the use of "non-traditional" species were addressed at the end of each of the questionnaires. These responses were recorded and were summarized in a word processor document.

Non-response Bias

This study used a sample frame consisting of cabinet, flooring, millwork, office furniture, dimension and component, windows and doors, and household furniture manufacturers in the US. Not all of the manufacturers that were sent a questionnaire participated in the survey. Companies that did not return the questionnaire were contacted to check for non-response bias. Five companies from each segment were contacted by phone and asked a few of the survey questions. This method for testing non-response bias was adopted from Dan Cumbo's thesis research (Cumbo, 2000).

Questions where means could be calculated were preferred for comparison. The question that was chosen dealt with component and component supplier attributes; this question was based on a 1 to 7 scale (1= Not Important, 7 = Very Important). From this question three attributes were randomly chosen. Only three were chosen for the reason of brevity. These attributes included *color*, *moisture content*, and *order lead-time*. The average responses from both the respondent group and the non-respondent group were compared by use of the independent t-test. The results of the t-test are displayed in Table 1.3.

Table 1.3: Non-response bias t-test results.

Attribute	Group	Mean	Std. Deviation	Significance
Color	Respondents	4.8	2.5	<0.001
	Non-respondents	5.5	1.5	
Moisture Content (MC)	Respondents	5.9	1.6	0.393
	Non-respondents	6.0	1.5	
Order lead-time	Respondents	5.9	1.2	0.416
	Non-respondents	5.5	1.4	

The t-test displayed that there is some difference between respondents and non-respondents on their importance of the attribute of color. A significance level of <0.001 is below the 95% testing level confidence. This indicates that respondents may feel that color is less of an importance than non-respondents. There is a possibility that the error exists because of the way the information was gathered, phone call vs. mail questionnaire. Within this group there is also a high degree of deviation between the respondents. This deviation may be the result of component products being used in different applications across the different market segments.

Questions were also asked about whether the non-respondents were members of trade associations and how many full-time employees were at their production facility.

No significant difference was found between the respondents and the non-respondents for these two questions.

Another way to test for non-response bias is to compare early respondents to late respondents (Armstrong and Overton, 1977). It is thought that late responses are a valid representation of non-responses. T-tests were again used to analyze the independent means of the attributes *color*, *moisture content*, and *order lead-time*. The test was performed on the first thirty responses and the last thirty responses. No significant differences were found between these attributes. Based on the results of the non-response tests, non-response bias could be removed as a limitation to this study.

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Chapter 2

Abstract

The secondary wood products industry represents a potential market for the use of "non-traditional" species. For this study "non-traditional" species are being defined as species that account for 5% or less of a market segments species mix. Currently the US secondary industry is using traditional species for the manufacture of their products. Red oak is the most popular species, which makes up approximately 43% of all wood species being used. Regional differences were also evident. The Western US was using mainly softwood, such as Douglas fir and ponderosa pine.

The secondary industry was found to be using an average of 3.1 million board feet of lumber per manufacturing facility. Southern companies were found to be larger and were using more lumber on average than the other regions. The manufacturers in the South were using approximately twice as much lumber as western companies who were the second highest user, using approximately 2.4 million board feet of lumber. Consistent supply was found to be the major concern for using raw material. Information is needed on "non-traditional" species' supply chain, properties, and uses before the secondary industry will be willing to use these species in their products.

Introduction

The secondary wood products industry represents a potential market for the use of "non-traditional" species. For this study "non-traditional" species are being defined as species that account for 5% or less of a market segments species mix. Currently the secondary wood products industry is using what is considered traditional hardwood species and grades. Hardwood sawmills within the United States are mainly producing species, such as red oak, yellow poplar, white oak, and maple (Bowe et al., 2000). These species are considered to be traditional species, because they have been commonly used in the past in wood manufacturing.

The US secondary hardwood industry is currently experiencing several raw material problems. The two main problems are the increasing cost of raw material and the declining availability of high-grade material. Sawmills have seen larger volumes of lower grade logs arrive at the sawmill, and these logs are yielding high amounts of undesirable and unmarketable lumber (Pohle, 2002). This problem may open the door for new species of wood to be utilized to fill the void where the higher grades of traditional species are lacking.

There is a good deal of motivation for secondary manufacturers to consider using different raw materials to produce their product. The price of hardwood lumber is increasing, and there is becoming a very limited supply of high quality/high grade material. In the last 10 years, lumber prices have risen dramatically for the traditionally used species, such as cherry, red oak, and hard maple. These prices have risen up to 130% from 1990 to 2001 (Meeks, 2001). It is becoming very difficult for most manufacturing operations to find sufficient supplies of desired raw material. This is due

to changes in the hardwood timber resources and an increasing export of hardwood lumber. Hardwood raw materials suffer from decreasing size of log diameter and a decline in log quality. As this trend continues, lower grade lumber will be produced (Meyer, 1996). A viable option for many manufacturers who do not want to use lower grade lumber is to consider using non-traditional species in place of many of the "normal" hardwoods they currently use.

Objective

The objective of this study was to estimate the percentage of "non-traditional" species used in the secondary industry.

Methodology

A mail survey was used to collect primary data. The research population of interest included manufacturers of wood components and wood component consuming market segments. Seven market segment specific questionnaires were developed to gather information for the fulfillment of the study objectives. Members of the Virginia Polytechnic Institute and State University faculty and employees of the sponsor organization (Forintek, Canada) reviewed the questionnaire for clarity. To test the preliminary questionnaire, it was faxed to at least three companies within each of the seven market segments. When at least one questionnaire from each of the market segments was returned, final adjustments were made and the revised questionnaires were mailed in January 2003.

The sample frame consisted of seven sectors of the secondary wood products industry including manufacturers of: cabinets, flooring, millwork, office furniture, dimension and components, windows and doors, and household furniture. The sample

frame was composed using the American Business Disc 2002 (Info USA, 2002). Companies were eliminated that had less than 20 employees. It was assumed that larger companies (i.e., companies with more than 20 employees) would be more likely to adopt the use of new species.

Non-response Bias

This study used a sample frame consisting of cabinet, flooring, millwork, office furniture, dimension and component, windows and doors, and household furniture manufacturers in the US. Not all of the manufacturers that were sent a questionnaire participated in the survey. Companies that did not return the questionnaire were contacted to check for non-response bias. Five companies from each segment were contacted by phone and asked a few of the survey questions. This method for testing for non-response bias was adopted from Dan Cumbo's thesis research (Cumbo, 1999).

Questions where means could be calculated were preferred for comparison. The question that was chosen dealt with component and component supplier attributes; this question was based on a 1 to 7 scale (1= Not Important, 7 = Very Important). From this question three attributes were randomly chosen. Only three attributes were used for the reason of brevity. These attributes included *color*, *moisture content*, and *order lead-time*. The average responses from both the respondent group and the non-respondent group were compared by the use of independent t-test. The results of the t-test are displayed in Table 2.1.

Table 2.1: Non-response bias t-test results.

Attribute	Group	Mean	Std. Deviation	Significance
Color	Respondents	4.8	2.5	<0.001
	Non-respondents	5.5	1.5	
Moisture Content (MC)	Respondents	5.9	1.6	0.393
	Non-respondents	6.0	1.5	
Order lead-time	Respondents	5.9	1.2	0.416
	Non-respondents	5.5	1.4	

The t-test displayed that there is some difference between respondents and non-respondents on their importance of the attribute of color. A significance level of <0.001 is below the 95% testing level confidence. This indicates that respondents may feel that color is less of an importance than non-respondents. There is a possibility that the error exists because of the way the information was gathered, phone call vs. mail questionnaire. Within this group there is also a high degree of deviation between the respondents. This deviation may be the result of component products being used in different applications across the different market segments.

Questions were also asked about whether the non-respondents were members of trade associations and how many full-time employees were at their production facility. No significant differences were found between the respondents and the non-respondents for these two questions.

Another way to test for non-response bias is to compare early respondents to late respondents (Armstrong and Overton, 1977). It is thought that late responses are a valid representation of non-responses. T-tests were again used to analyze the independent means of the attributes *color*, *moisture content*, and *order lead-time*. The test was performed on the first thirty responses and the last thirty responses. No significant

difference found in any of these attributes. Based on the results of the non-response tests, non-response bias could be removed as a limitation in this study.

Results

Survey data was entered into the SPSS (SPSS, 2003) statistical software package for analysis. A total of 763 questionnaires were returned. Of those, 357 were deemed usable, resulting in an overall response rate of 14.3%. There were 238 undeliverable questionnaires and 168 returned questionnaires by companies that are not participating in operations this study was targeting. After these questionnaires were eliminated, the adjusted response rate was 16.8%. As the questionnaires were returned they were separated into the seven separate market segments. The numbers of responses in each of the market segments are as follows: cabinets (72), flooring (39), millwork (79), office furniture (37), dimension and components (38), windows and doors (36), and household furniture (56). These responses resulted in response rates of 16.9% for cabinets, 20.7% for flooring, 15.7% for millwork, 16.2% for office furniture, 11.2% for dimension and components, 7.6% for windows and doors, and 16.2% household furniture. After removing the non-usable questionnaires the adjusted response rates are 18.1% for cabinet manufacturers, 25.9% for flooring manufacturers, 17.8% for millwork producers, 18.4% for office furniture producers, 14.5% for dimension and components manufacturers, 9.2% for windows and doors producers, and 18.6% for household furniture manufacturers.

Secondary Industry

Profile

Of the returned questionnaires most were from the millwork and cabinet segments. The other five segments had made up a lower percentage of the data collected (Figure 2.1).

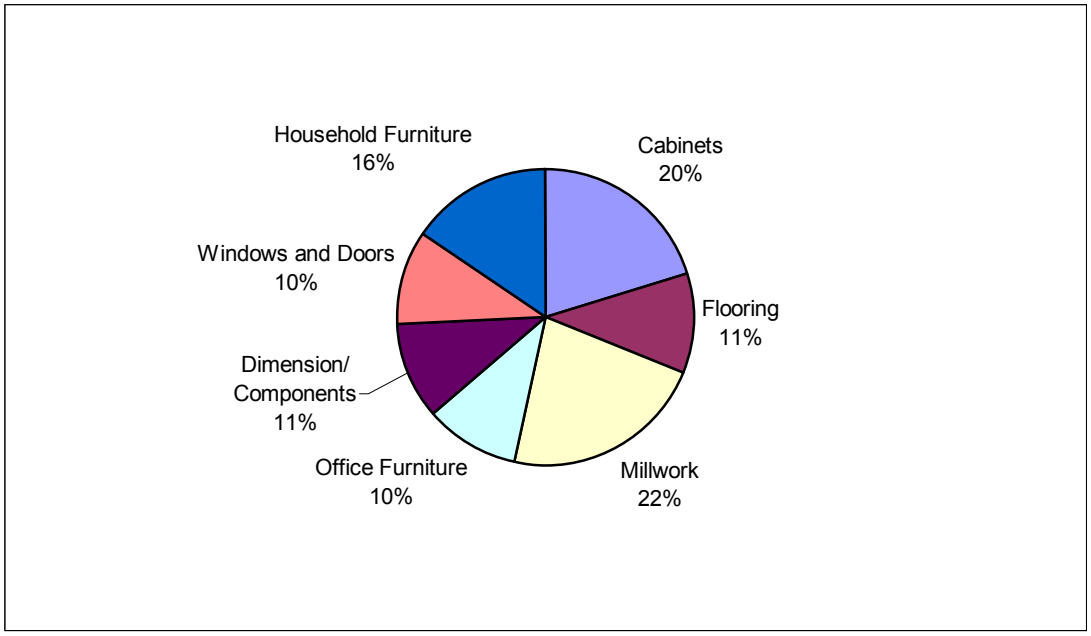

Figure 2.1: Percentage of data recorded from each industry surveyed.

The distribution across the United States (US) was recorded. The US was divided into four regions for analysis. The Northeast region included of the following states: Maine, Connecticut, Delaware, New Hampshire, Vermont, New Jersey, New York, Pennsylvania, and Rhode Island. The North was composed of Maryland, West Virginia, Ohio, Michigan, Illinois, Indiana, North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Missouri, Nebraska, Kansas, and Wisconsin. States designated as Southern were Florida, Georgia, Texas, Oklahoma, Tennessee, Alabama, Mississippi, Louisiana, Kentucky, South Carolina, North Carolina, Virginia, and Arkansas. The Western states

were defined as Washington, Oregon, California, Arizona, Utah, Idaho, Montana, Wyoming, New Mexico, Colorado, Nevada, Alaska, and Hawaii. The Northern region and the Southern region returned the highest amounts of questionnaires. The Northeast region and the Western region had a lower response (Figure 2.2).

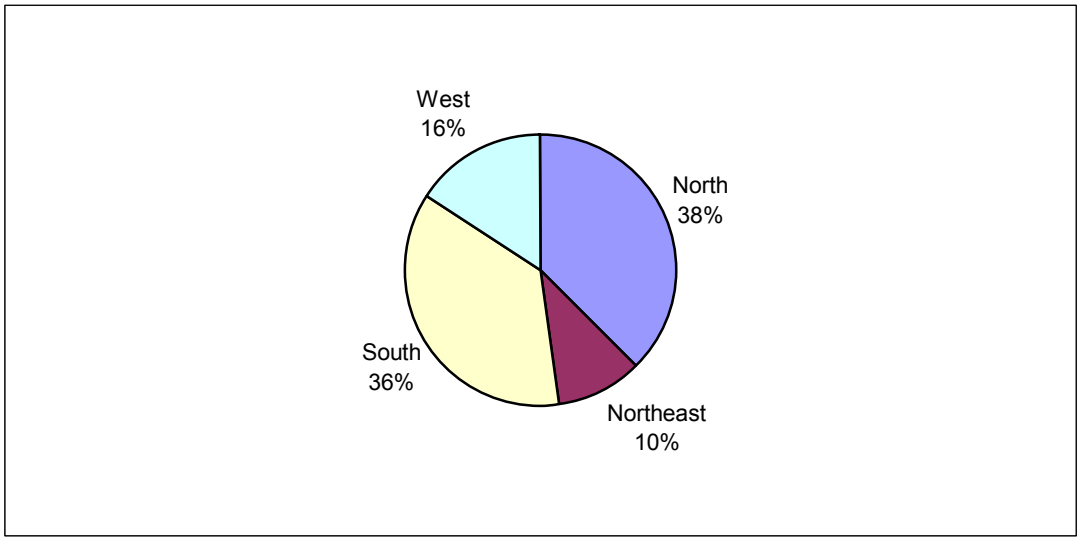

Figure 2.2: Regional distribution of the respondents.

Respondents were asked if they were part of a multiple facility company or had only a single production facility. Within the secondary industry 72% of the respondents were part of a single operation. The majority of the secondary industry respondents were involved in trade associations. Approximately 64% of the respondents were a member in some type of association. The associations differed significantly across the seven market segments. Most of the associations listed were focused on individual market segments. Approximately one-half of secondary wood manufacturer's facilities had less than 50 full-time employees. Twenty-one percent of the companies had less than 25 employees, with only 3.7% employing more that 400 people (Table 2.2).

Table 2.2: Full-time employees at the respondents facility.

	# of respondents	% of respondents
Fewer than 25	76	21.5
25-50	114	32.2
51-100	81	22.9
101-200	34	9.6
201-300	23	6.5
301-400	13	3.7
Greater than 400	13	3.7

Data on gross sales for the companies were gathered. The most frequent response was greater than $1 million, but less than $5 million (Table 2.3).

Table 2.3: Total gross sales by secondary wood manufacturers.

	# of respondents	% of respondents
Less than $1,000,000	12	3.4
$1,000,001 - $5,000,000	141	40.5
$5,000,001 - $15,000,000	98	28.2
$15,000,001 - $25,000,000	28	8.0
$25,000,001 - $50,000,000	24	6.9
Greater than $50,000,000	45	12.9

Raw Material Use

The average annual lumber input volume at each production facility was calculated at 3.1 million board feet. Facilities in the South used, on average, more lumber than facilities in the other three regions (Figure 2.3).

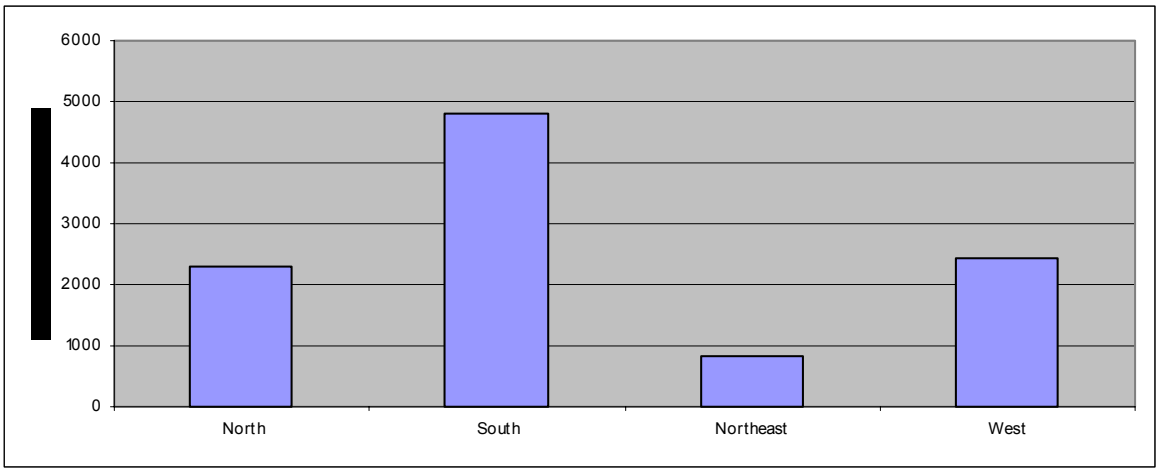

Figure 2.3: Mean lumber input by secondary wood using companies within each region.

This study was designed to gather information on the type of species of wood being used. The type of species being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their products. Respondents could select among the 19 species listed or an "Other" category, which allowed the respondent to add any species, which we may have omitted. Table 2.4 shows the average board footage use of each species. Red oak is the most common used species with an average of 1.3 million board feet. "Traditional" species for the secondary industry were defined as red oak, white oak, hard maple, cherry, soft maple, and yellow poplar. "Non-traditional" species used was estimated to be 28.5%. This means that within the secondary industry over 71% of the species mix is comprised of the six above-mentioned species.

Table 2.4: Average percentage of species and volume used among the wood secondary industry.

Species	% Used	Board Feet in Thousands
Red Oak	43.5	1347.5
White Oak	10.2	316.9
Hard Maple	9.8	304.9
Cherry	5.0	154.0
White Pine	0.8	24.4
Ponderosa Pine	5.3	164.0
Hickory	1.4	43.7
Ash	1.9	60.0
Soft Maple	3.5	107.3
Hybrid Poplar	1.0	30.5
Southern Yellow Pine	0.3	8.7
Radiata Pine	3.7	113.8
Douglas Fir	1.2	37.6
Yellow Birch	1.1	33.6
Yellow Poplar	6.7	206.1
Aspen	0.2	7.5
White Birch	0.2	6.4
Gum	0.6	17.2
Alder	0.5	15.3
Other	3.1	96.0

Regional differences in species used also differed. The preferred species in the North and South was red oak. The Northern region also used, on average, approximately 500,000 board feet of hard maple (Figure 2.4). The Northeast facilities used cherry more than any of the other species (Figure 2.5). The Southern region was using considerably more yellow poplar than the other three regions (Figure 2.6). In the West softwoods were used more, including Douglas fir, ponderosa pine, and radiata pine being used in large quantities (Figure 2.7).

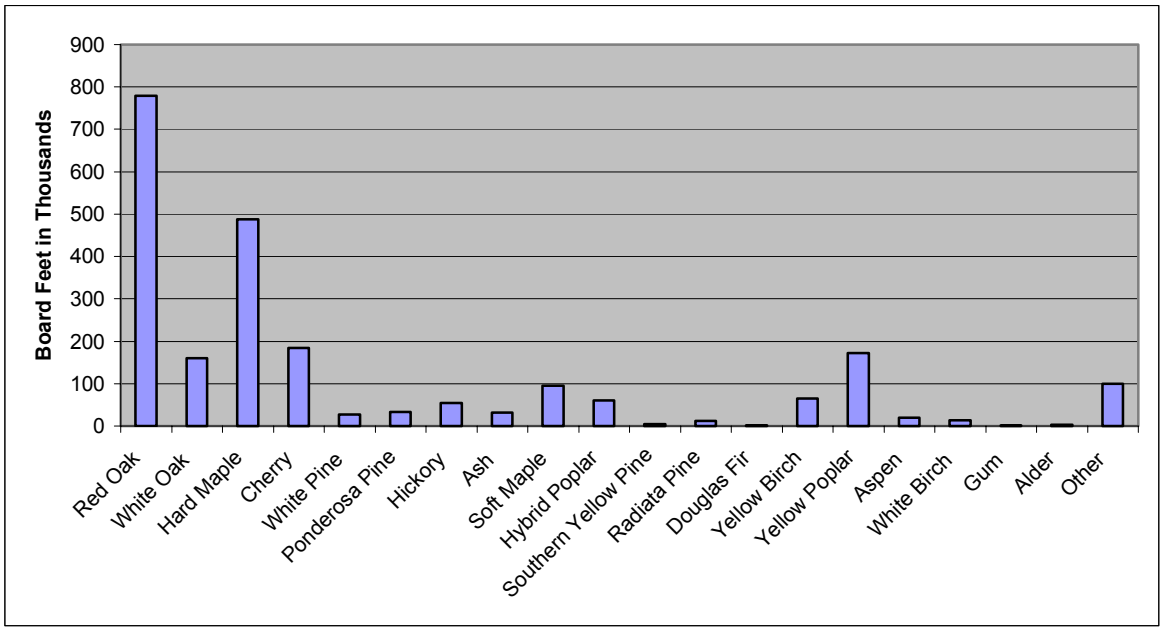

Figure 2.4: Mean species use in the Northern region.

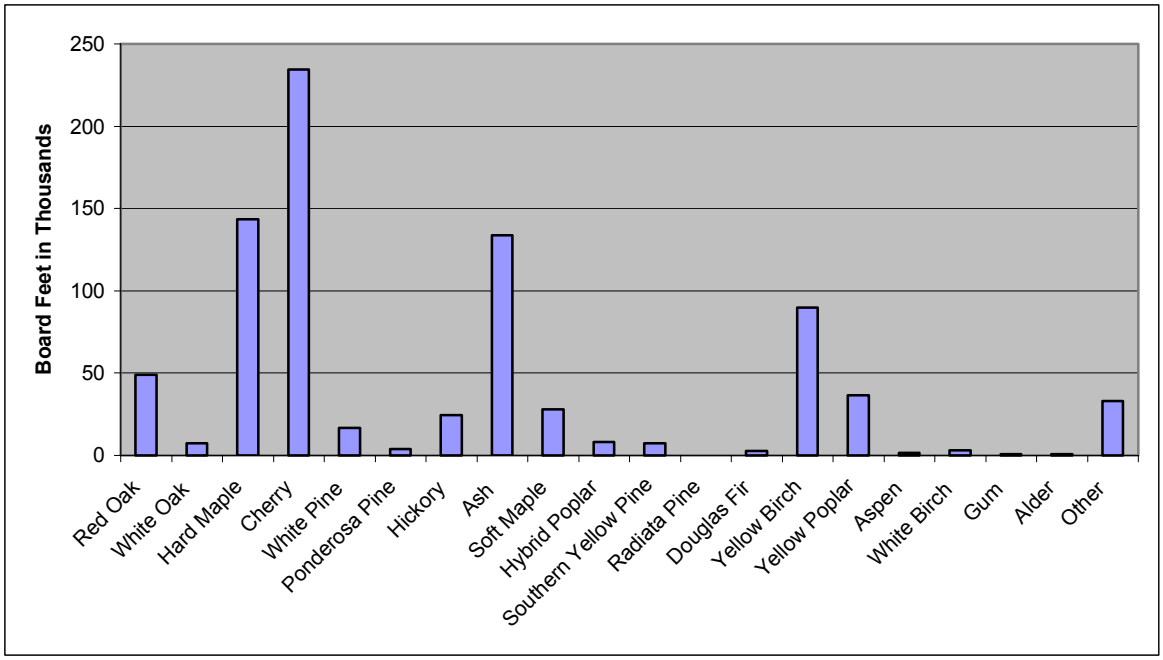

Figure 2.5: Mean species use in Northeastern states.

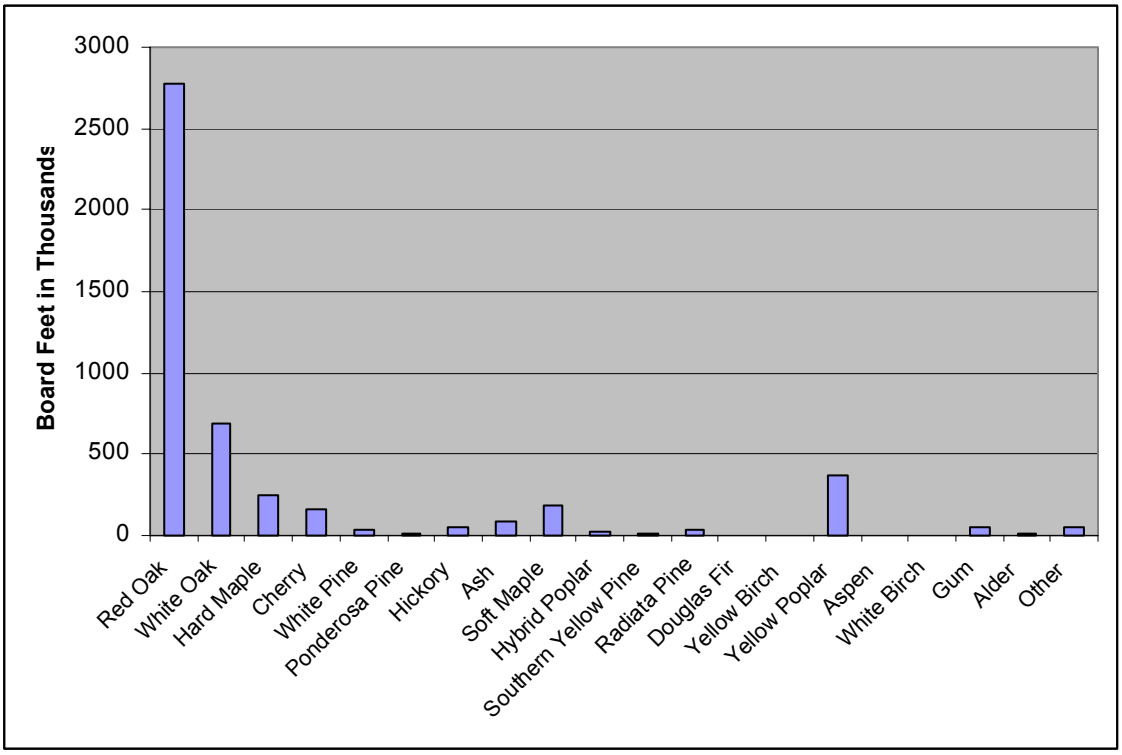

Figure 2.6: Mean species use in the Southern region of the US.

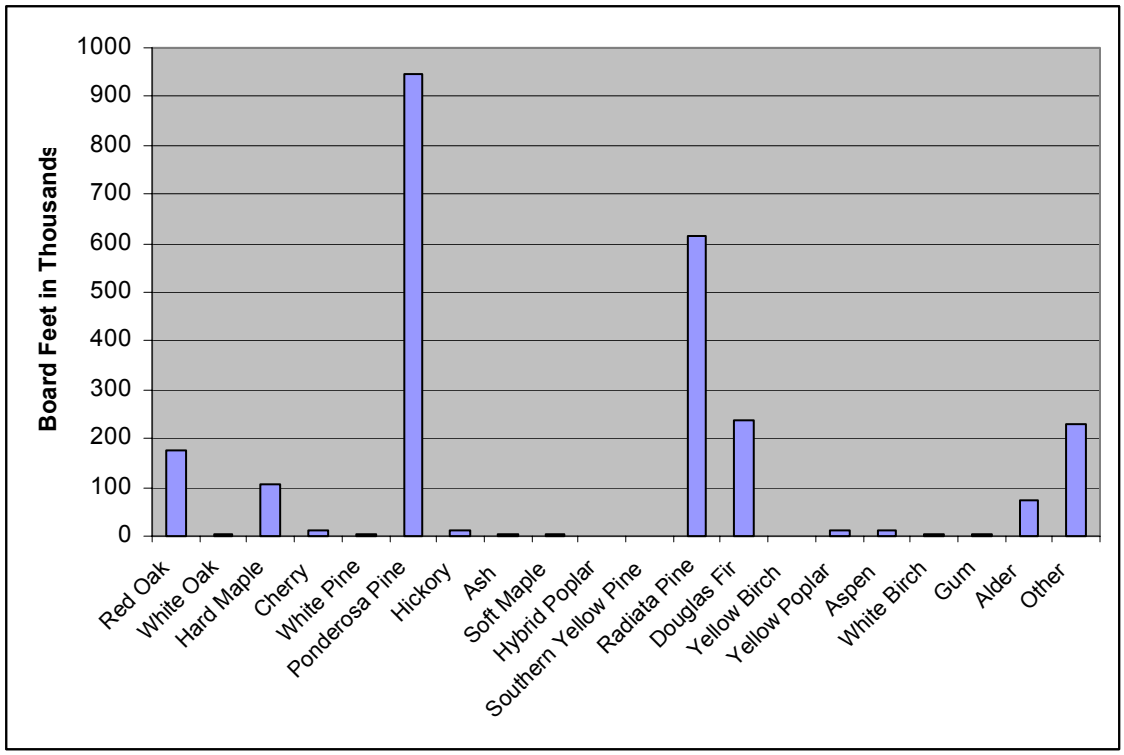

Figure 2.7: Mean species use in the Western region

Respondents were asked to assess the percentage of their companies cost associated with their wood raw material. On average respondents reported 39.7% of their costs are associated to their wood material.

Certification of raw materials has also been a major issue within the forest products industry. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. Within the secondary wood industry only 13.2% of companies are using certified materials. Thirty-five percent of respondents indicated that they either didn't know what certification is or they were unaware if their company was using any certifying agencies. The rest of the respondents answered that they did not use any certified raw material.

Participants of the survey were asked to rate the importance of many attributes that they demand in the wood products they purchase. This question was based on a

Likert type rating scale, (1 = Not Important, 7 = Very Important). Table 2.5 shows the means that were calculated for the wood secondary industry. The attribute that rated the highest was consistent supply, with a mean of 6.1. Low price was rated second to last in importance, which may be viewed as a surprise in this industry.

Table 2.5: Average rating given to attributes that deal with wood components.

Attribute	Mean
Consistent supply	6.1
Service	6.0
Moisture Content (MC)	6.0
On-time delivery	5.9
Consistency of MC	5.9
Straightness	5.8
Proper dimensions	5.7
Blue/mineral stain-free	5.6
Price stability	5.6
Finishability	5.5
Color	5.5
Machinability	5.5
Order lead-time	5.5
Lack of knots	5.3
Wane-free	5.2
Low price	5.2
Mechanical properties	5.0

Scale (1 = not important, 7 = very important)

Respondents were asked what were the major factors that they considered when choosing a species of components to use. Component manufacturers were not asked this question. The other six market segments indicated that customer demand was the main factor with over 85% of companies responding to this answer. There was only one other response that had over 20% of respondents choosing the option, and that was cost, with 37.8% indicating this was a major factor.

Production Scheduling

Production scheduling questions were also asked to gain a better understanding of how each market segment handles their manufacturing process. Figure 2.8 illustrates the three different types of scheduling options, plus a category for the respondent to fill in as "Other." Order expediting was the process that one-half of the respondent companies used.

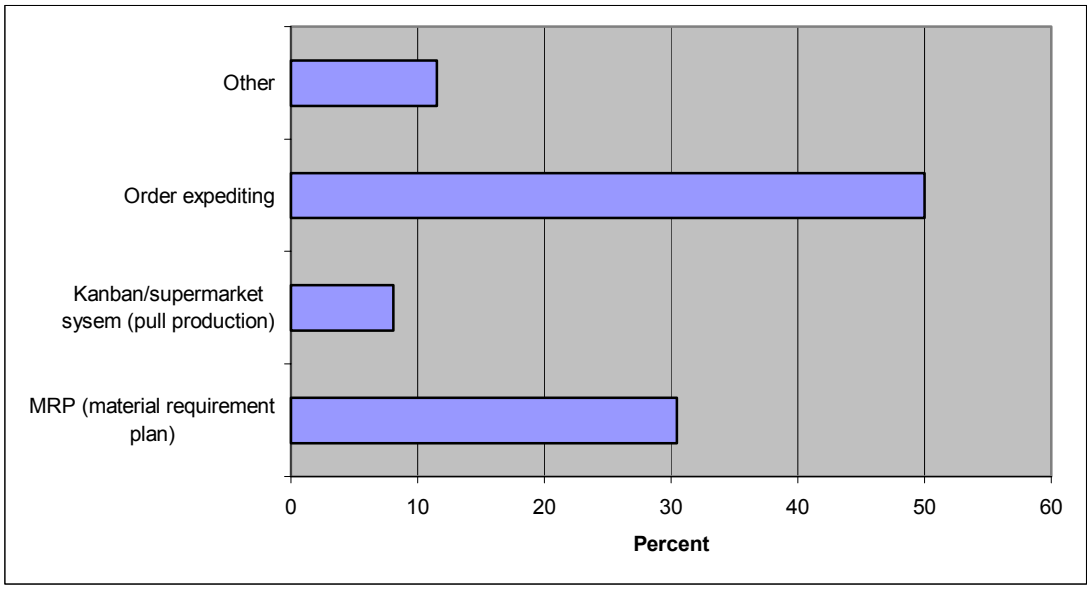

Figure 2.8: Percentage of respondents using different types of production scheduling.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 22 days. The production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 4.5. With this being the case it can be concluded that the average lead-time would vary even within each production facility.

Conclusions

Analysis showed that the secondary wood products industry is using a majority of "traditional" species to manufacture their products. For the secondary industry as a whole, oak was the most used species, which included the use of both red and white oak. Many of the properties of oak, which are considered valuable, are its color and mechanical properties. The research indicated that the secondary industry rated both of these attributes much lower than other attributes desired in their wood components. This possibly shows that the industry is just using traditional species because of tradition and consumer demand. If consumers could be educated on the properties of other species the industry may be more adept to change their species selection.

In the West, companies were using a larger amount of softwoods, such as ponderosa pine, Douglas fir, and radiata pine. These species would be considered "non-traditional" to most of the secondary wood products industry. One reason the companies in the West are able to use these species is because of an abundance of the timber resource in that region. The attribute, which was rated highest, was constant supply. This indicated that industry must know that there will always be a supply of the type of raw material they are using so they can continue to operate in a smooth manner. Many respondents noted that they were not sure where the supply of "non-traditional" species would come from, and that they also did not know if there would be a continued supply of this material. If other "non-traditional" species could be supplied with some consistency then the rest of the country would be able to adopt the use of these species in the same way the companies in the west.

Price is one aspect where the use of "non-traditional" species could aid companies in being competitive and successful. It was expected that most companies view cost of the raw material as a major factor that determines what type of material they are using. This study displayed results that concluded otherwise. In three separate areas of the questionnaire price or cost of raw material was discussed. In all of these areas there was a low rating of importance. Companies seemed to elude that price did not play as important as a role as had been thought. Price stability was one attribute that was rated slightly higher. Respondents to this research have indicated that having a consistent price is more important than have a low price in a fluctuating pricing system.

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Chapter 3

Abstract

The secondary wood products industry is a diverse industry. For this study seven segments from this industry were chosen to be surveyed: cabinets, millwork, flooring, office furniture, dimension and components, windows and doors, and household furniture. This study focused on "non-traditional" species use.

Currently the most popular species being used in the secondary industry is red oak. The flooring market segment reported the highest percentage of red oak use; approximately 68% of all of their lumber use was of this species. Not all of the market segments were using red oak as their primary wood species. The household furniture segment was using white oak, yellow poplar, and soft maple as their top three species. The number one species being used in the window and door segment was reported to be hard maple, which comprised 42.9% of their species mix.

Within all of the secondary industries' respondents stated that they would be willing to try new species if there was a market for them. Data on these species will need to be collected and reported to the secondary industry. The wood component manufacturers will also need to distribute this information to designers, architects, and consumers as well. Most of the respondents to this survey are prepared to use other species. Getting consumers to accept the "non-traditional" species will be the way that these species begin to get used.

Introduction

The secondary wood products industry is a diverse industry. For this study seven segments from this industry were chosen to be surveyed: cabinets, millwork, flooring, office furniture, dimension and components, windows and doors, and household furniture. This study focused on "non-traditional" species use.

The secondary industry was targeted for this study because it uses a large amount of lumber, especially hardwood lumber (Hansen and West, 1998). The secondary industry uses a wide range of hardwood species and grades. In 1999, hardwood sawmills in the United States produced 34% red oak, 16% yellow poplar, 15.5% white oak, 8.8% hard maple, 5.9% soft maple, 4.7% black cherry, and the remainder of 15.1% was composed of a wide variety of other species (Bowe et al. 2000). These species are considered to be traditional species, because they have been commonly used in the past in wood manufacturing.

The main goal of this study was to evaluate the use of "non-traditional" species in the wood component market segment. Information on the dimension segment is lacking, even though component producers play a large role in the valued-added chain of wood manufacturing. Hardwood components represent a great opportunity for companies to capture more value out of their product. By producing wood components US manufacturers would utilize more labor and this would encourage a larger amount of investments in new technologies to manufacture these goods (Haas and Smith, 1997). This research was able to show the type of species these manufacturers were using and how this segment operated.

The markets for dimension and component products were also evaluated. The furniture market segment is one of the largest consumers of component products. In 1993, the furniture segment consumed roughly 254 million board feet of dimension parts and 1.8 million board feet of hardwood lumber. From 1993 to 1995, the use of dimension parts was predicted to increase by about 14% to 288.6 million board feet in 1995, while lumber use was expected to rise by 15% (Hansen et al., 1995). This indicates a decrease in the use of dimension lumber, however in 1997 about 50% of the lumber that was used to produce furniture was dimension (Hansen and West, 1998), indicating that there was actually an increase of dimension lumber utilization.

The wood cabinet market segment is also a major consumer of wood dimension products. It was estimated in 1999 that the total lumber use for the cabinet segment was 843 million board feet. The use of hardwood lumber, excluding dimension, was approximately 484 million board feet. An increase of 16% to 562.7 million board feet was predicted for 2001. The use of parts and components was estimated in 2001 to be 68.3 million cabinet doors, 26.3 million board feet of edge-glued panels and cut-to-size blanks, and 31.8 million board feet of other cabinet parts. This use of components and parts is roughly 215 million board feet (Olah, 2000). Olah (2000) estimated that about 358 million board feet of hardwood lumber was used to produce these 215 million board feet, adding up to the total lumber use in the cabinet market segment of 843 million board feet. In 2000 Cumbo et al. calculated the average annual lumber throughput for a cabinet manufacturer to be 1.3 million board feet (Cumbo, et al., 2001).

Building products, which includes millwork and windows and doors, was the other market studied in this research. The millwork segment is different from the other

segment in that softwoods are used commonly. Approximately 75% of mouldings and millwork are made from softwoods, while 25% are made from hardwoods. The predominant softwood species included ponderosa pine, Douglas fir, southern pine, true firs, and eastern white pine. Red oak and, increasingly, yellow poplar are the primary hardwoods used in this market. It was estimated in 1990 that nearly one billion board feet of lumber was used in the millwork and moulding segment.

According to the "Annual Survey of Manufacturers" the window and door market segment shipped goods that totaled over $10.8 billion (US Census Bureau, 2002). The wood window and door segment is highly linked to the new construction and remodeling sectors. In 1992, 60% of wood doors and 63% of wood windows were sold for residential repair and remodeling projects (Lee and Greber, 1996). With the recent slowdown in the economy we are seeing a decrease in the amount of housing starts across the country. This slowdown of construction will cause the window and door segment to have reductions in volumes and increased competition for business. Some changes that are taking place in the window and door market segment are a gradual change in material. The market segment has seen a significant increase in vinyl products, along with a growth in demand for wood/non-wood composite material (Campbell, 2001). It is hypothesized that this could be an area where the use of "non-traditional" species could be implemented.

Objective

The objective of this study was to identify wood component manufacturers' and component consuming market segments' perceptions on increased use of "non-traditional" wood species.

Methodology

A mail survey was used to collect data. A mail survey was chosen because of the large sample population and the large number of questions. The research population of interest included manufacturers of wood components and wood component consuming market segments. Seven market segment specific questionnaires were developed to gather information for the fulfillment of the study objectives. Members of the Virginia Polytechnic Institute and State University faculty and employees of the sponsor organization (Forintek, Canada) reviewed the questionnaire for clarity and usefulness of the questions. To test the preliminary questionnaire was faxed to at least three companies within each of the seven market segments for their review. When at least one questionnaire from each of the market segments was returned, final adjustments were made and the revised questionnaires were mailed in January 2003.

The sample frame consisted of seven sectors of the secondary wood products industry manufacturers of: cabinets, flooring, millwork, office furniture, dimension and components, windows and doors, and household furniture. The sample frame for six of the market segments was composed using the American Business Disc 2002 (Info USA, 2002). The sample frame for the flooring market segment was a mailing list compiled by the Center for Forest Products Marketing and Management at Virginia Tech. Companies with less than 20 employees were eliminated. It was assumed that larger companies (i.e., companies with more than 20 employees) would be more likely to adopt the use of new species.

Non-response Bias

This study used a sample frame consisting of cabinet, flooring, millwork, office furniture, dimension and component, windows and doors, and household furniture manufacturers in the US. Not all of the manufacturers that were sent a questionnaire participated in the survey. Companies that did not return the questionnaire were contacted to check for non-response bias. Five companies from each segment were contacted by phone and asked a few of the survey questions. This method for testing for non-response bias was adopted from Dan Cumbo's thesis research (Cumbo, 1999).

Questions where means could be calculated were preferred for comparison. The question that was chosen dealt with component and component supplier attributes; this question was based on a 1 to 7 scale (1= Not Important, 7 = Very Important). From this question three attributes were randomly chosen. Only three attributes were used for the reason of brevity. These attributes included *color*, *moisture content*, and *order lead-time*. The average responses from both the respondent group and the non-respondent group were compared by the use of independent t-test (Table 3.1).

Table 3.1: Non-response bias t-test results.

Attribute	Group	Mean	Std. Deviation	Significance
Color	Respondents	4.8	2.5	<0.001
	Non-respondents	5.5	1.5	
Moisture Content (MC)	Respondents	5.9	1.6	0.393
	Non-respondents	6.0	1.5	
Order lead-time	Respondents	5.9	1.2	0.416
	Non-respondents	5.5	1.4	

The t-test displayed that there is some difference between respondents and non-respondents on their importance of the attribute of color. A significance level of <0.001 is below the 95% testing level confidence. This indicates that respondents may feel that

color is less of an importance than non-respondents. There is a possibility that the error exists because of the way the information was gathered, phone call vs. mail questionnaire. Within this group there is also a high degree of deviation between the respondents. This deviation may be the result of component products being used in different applications across the different market segments.

Questions were also asked about whether the non-respondents were members of trade associations and how many full-time employees were at their production facility. No significant difference was found between the respondents and the non-respondents for these two questions.

Another way to test for non-response bias is to compare early respondents to late respondents (Armstrong and Overton, 1977). It is thought that late responses are a valid representation of non-responses. T-tests were again used to analyze the independent means of the attributes *color*, *moisture content*, and *order lead-time*. The test was performed on the first thirty responses and the last thirty responses. There was no significant difference found in any of these attributes. Based on the results of the non-response tests, non-response bias could be removed as a limitation in this study.

Results

Survey data was entered into the SPSS (SPSS, 2003) statistical software package for analysis. A total of 763 questionnaires were returned. Of those, 357 were deemed usable, resulting in an overall response rate of 14.3%. There were 238 undeliverable questionnaires and 168 returned questionnaires by companies that are not participating in operations this study was targeting. After these questionnaires were eliminated, the adjusted response rate was 16.8%. As the questionnaires were returned they were

separated into the seven separate market segments. The numbers of responses in each of the market segments are as follows: cabinets (72), flooring (39), millwork (79), office furniture (37), dimension and components (38), windows and doors (36), and household furniture (56). These responses resulted in response rates of 16.9% for cabinets, 20.7% for flooring, 15.7% for millwork, 16.2% for office furniture, 11.2% for dimension and components, 7.6% for windows and doors, and 16.2% household furniture. After removing the non-usable questionnaires the adjusted response rates are 18.1% for cabinets, 25.9% for flooring, 17.8% for millwork, 18.4% for office furniture, 14.5% for dimension and components, 9.2% for windows and doors, and 18.6% for household furniture.

Component Manufacturers

Profile

The wood dimension and components market segment returned 38 completed questionnaires (14.5% response rate). The regional distribution of the respondents within this segment is shown in Figure 3.1. The Northeast region was composed of the following states; Maine, Connecticut, Delaware, New Hampshire, Vermont, New Jersey, New York, Pennsylvania, and Rhode Island. The North was composed of Maryland, West Virginia, Ohio, Michigan, Illinois, Indiana, North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Missouri, Nebraska, Kansas, and Wisconsin. The Southern states were Florida, Georgia, Texas, Oklahoma, Tennessee, Alabama, Mississippi, Louisiana, Kentucky, South Carolina, North Carolina, Virginia, and Arkansas. The Western states were defined as Washington, Oregon, California, Arizona, Utah, Idaho, Montana, Wyoming, New Mexico, Colorado, Nevada, Alaska, and Hawaii.

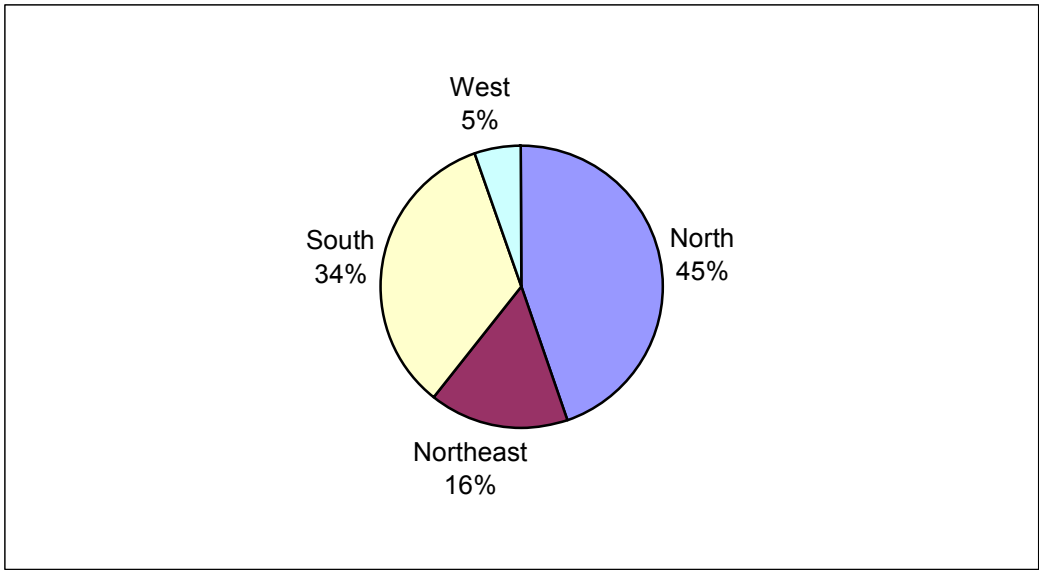

Figure 3 1: Dimension and component respondents by region.

Respondents were asked if they were part of a multiple facility company or a single production facility. Within this segment 62.3% of the respondents were part of a single operation. The component market segment respondents were also active in trade associations with 65.8% being members. The Wood Component Manufacturers Association (WCMA) was the most common association. The majority of component manufacturing facilities had less than 50 full-time employees. Twenty-three percent of the companies had less than 25 employees and 36.8% had between 25-50 employees (Table 3.2).

Table 3.2: Full-time employees at the respondents production facility.

	# of respondents	% of respondents
Fewer than 25	9	23.7
25-50	14	36.8
51-100	8	21.1
101-200	5	13.2
301-400	2	5.3

Gross sales for the companies were gathered. Sales figures indicate that all of the respondent's companies have sales that exceed $1,000,000 (Table 3.3).

Table 3.3: Total gross sales by component companies.

	# of respondents	% of respondents
$1,000,001 - $5,000,000	17	44.7
$5,000,001 - $15,000,000	11	28.9
$15,000,001 - $25,000,000	3	7.9
$25,000,001 - $50,000,000	2	5.3
Greater than $50,000,000	4	10.5

Many of the companies also produce other products besides components (Table 3.4). Flooring and millwork were the largest percentage of other products being made.

Table 3.4: Percentage of respondent companies that also produce other products.

Cabinets	Flooring	Millwork	Office Furniture	Windows and Doors	Household Furniture	Other
5.3%	21.1%	26.3%	2.6%	2.6%	13.2%	7.9%

Raw Material Use

The average annual lumber input volume at each production facility was calculated 3.9 at million board feet. The lumber input was calculated for both hardwood and softwood. Hardwood accounts for 3.8 million board feet, whereas softwood lumber is 54 thousand board feet. Figure 3.2 shows the lumber input broken down by region.

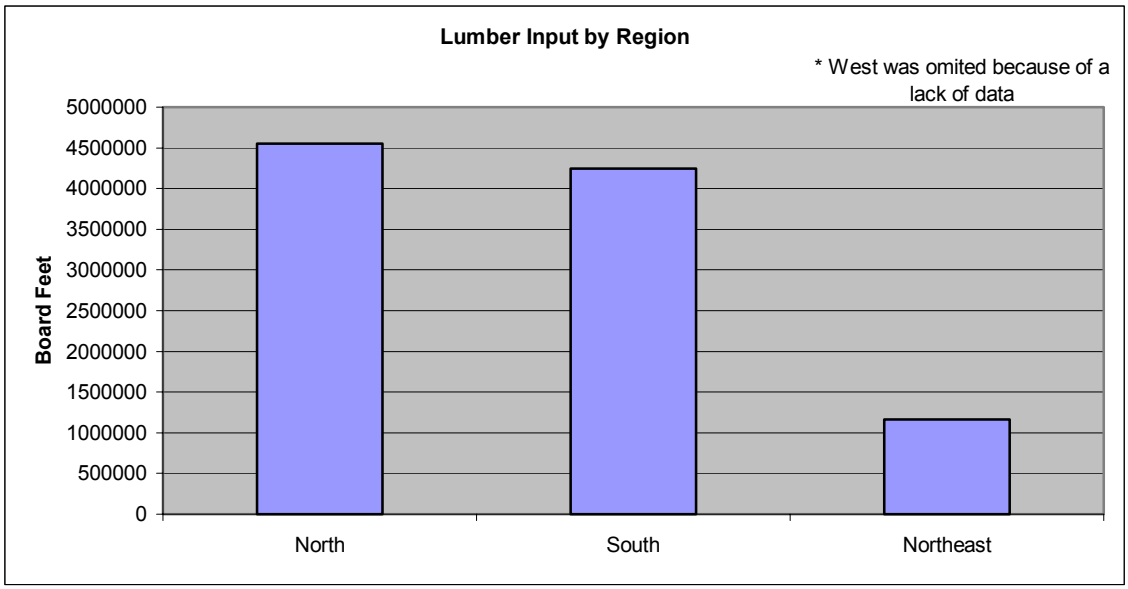

Figure 3 2: Mean lumber input by component companies by region.

Data was gathered on the type of solid raw material they are using to produce their dimension and component products. Figure 3.3 displays the percentages of each of the raw materials used, excluding panel products.

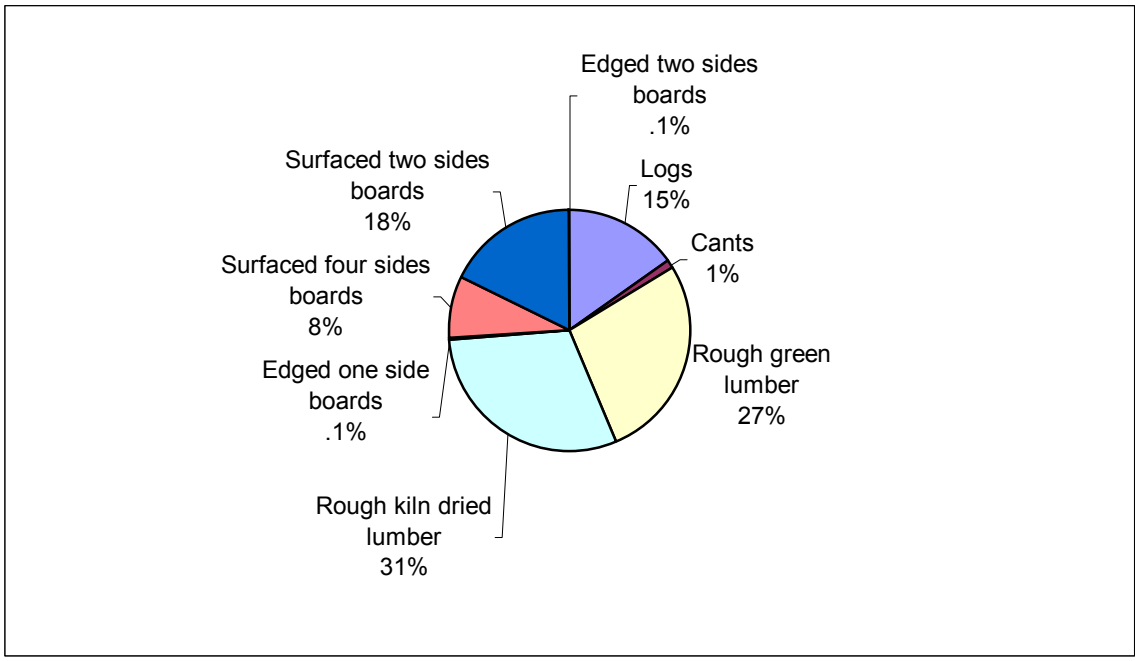

Figure 3.3: Average percentage of raw material purchases.

Respondents used an average of 1 million square feet of panel products. The panel products were then broken down into five categories; softwood plywood, hardwood plywood, MDF, particleboard, and other (Table 3.5).

Table 3.5: Average usage of panel products within the component market segment.

Softwood Plywood	Hardwood Plywood	MDF	Particleboard	Other
16563 sq. ft.	1023344 sq. ft.	15569 sq. ft.	15375 sq. ft.	1563 sq. ft.

Respondents were asked to assess what percentage of their companies cost was associated with their wood raw material. On average respondents reported 53% of their costs are associated with wood material. This was higher than many of the other market segments that participated in the study. A potential reasoning for this high cost is that

82% of their raw material is purchased from outside vendors. Only 18% of the material they are using is obtained from company owned/affiliated sources.

One of the study's goals was to determine if wood component companies are willing to change the products they are currently using. We asked manufacturers if they had switched their primary raw material in the past five years. The results of this question show that only 18.4% of the respondents had switched their material use.

Certification of raw materials has also been a major issue within the forest products industry. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. Sixty-eight percent of respondent companies do not participate in any certification and 13.2% of respondents answered that they either do not know what certified raw material is or they do not know if their company uses any certified products. Eighteen percent of companies that used certified raw materials were then asked to please list all certifying agencies that their company deals with. FSC, SFI, and SmartWood were all listed as third party certification agencies that the component market segment used.

The respondents were asked what type of lumber purchasing strategy their company participates in. Seventy-five percent of component companies attempt to obtain highest possible yields from lower grades of lumber, whereas 25% of respondent companies purchase high grades of lumber only. Table 3.6 displays the average percentages of grades that are purchased by this segment. This data matches the previous data by showing that most of the lumber purchased is No. 1 Common and above. Component manufacturers take lumber and remove defects as they produce their component products. This manufacturing procedure allows them to use lower grade

lumber to produce high quality products. Table 3.7 also lists softwood usage within the component market segment. It is evident from this data that most component manufacturers only use a small amount of softwood lumber.

Table 3.6: Average percentage use of the different grades of hardwood and softwood lumber by component manufacturers.

Hardwood	% Used	Softwood	% Used
FAS	9.1	Selects	1.9
Selects	5.9	#1	44.8
No. 1 Common	48.8	#2	44.1
No. 2 Common	28.6	#3	9.1
#3 A	7.6	Utility	0.0
#3 B	0.0	Appearance	0.0

This study was designed to gather information on the species of wood being used within each market segment. The type of species being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their product. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list. Table 3.7 shows the average board footage use of each species. Red oak is the most commonly used specie with 1.2 million board feet being used by the average component manufacturer. "Traditional" species were defined as red oak, white oak, hard maple, cherry, ash, and soft maple for the component market segment. "Non-traditional" species use was relatively low in this segment with only 20% of the average species mix being these species. The average company was using 222,000 board feet of yellow poplar along with 230,000 board feet of soft maple. Two "non-traditional" species that were used the most by respondents were gum and

hickory. Many of the species that are currently being used in this segment that are not part of this list were reported to be walnut, beech, basswood, and mahogany.

Table 3.7: Average percentage of species use among wood component manufacturers.

Species	% Used	Board Feet in Thousands
Red Oak	31.3	1209.4
White Oak	10.4	400.0
Hard Maple	9.8	376.8
Cherry	11.9	459.3
White Pine	0.3	12.1
Ponderosa Pine	0.0	0.0
Hickory	2.6	100.1
Ash	5.1	196.9
Soft Maple	6.0	230.1
Hybrid Poplar	2.8	106.5
Southern Yellow Pine	0.2	8.9
Radiata Pine	0.0	0.0
Douglas Fir	0.0	0.0
Yellow Birch	2.2	84.7
Yellow Poplar	5.8	222.5
Aspen	0.7	28.2
White Birch	0.4	14.1
Gum	3.5	134.4
Alder	0.1	5.7
Other	7.0	271.8

Components Produced

Our research indicated that 41% of the components being produced were blanks. Semi-finished and finished components accounted for 37% and 22% respectively, of the other types of components being manufactured. Most of the respondents said that their components would be used in visual applications, approximately 82%, with only 18% of the components being used in non-visual applications such as, internal furniture parts or industrial applications.

Manufacturers were asked to report the percentage of their product that goes to which secondary industries. Figure 3.4 illustrates that the cabinet segment and household

furniture purchased more components than any other market segments. The other secondary industries accounted for almost all of the rest of the component products, with a small amount of components being sold to pallet manufacturers along with gun stock manufacturers.

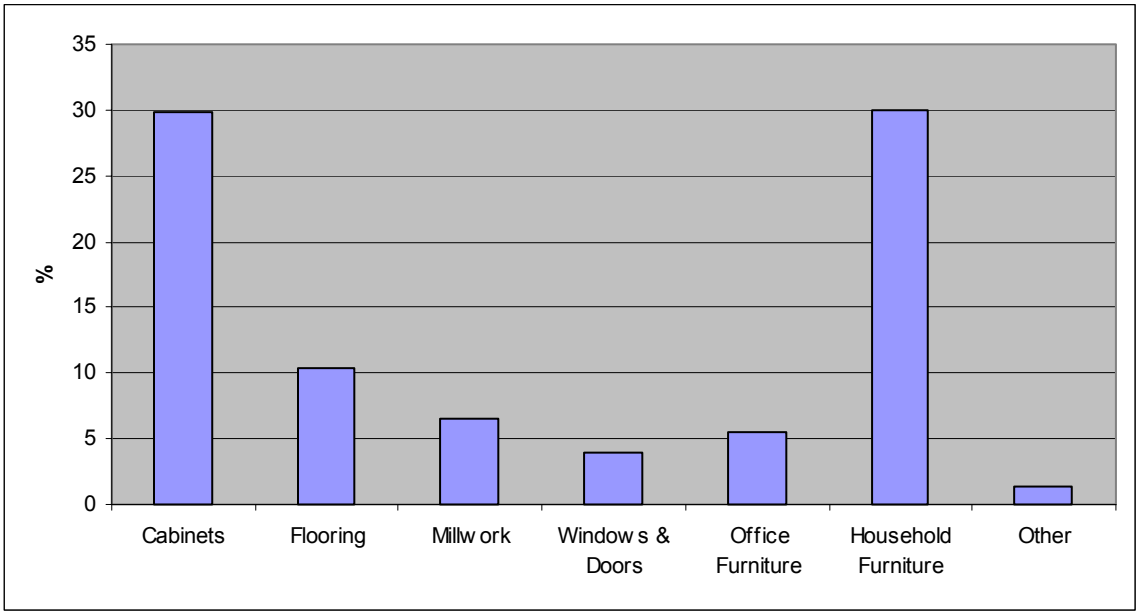

Figure 3.4: Percentage of wood components sold to individual market segment.

Participants of the survey were asked to rate the importance of many attributes that they demand in the wood products they purchase. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). Table 3.8 shows the means that were calculated for the wood component market segment. The two attributes that had the highest means were proper dimensions and consistent supply. Price stability with a mean of 5.5 and low price with a mean of 5.0, indicate that the market segment is much more concerned with having a consistent product, than with having a less expensive raw material.

Table 3.8: Average ratings for material attributes that deal with the wood products purchased by the wood component market segment.

Wood products attributes	Mean
Proper dimensions	6.1
Consistent supply	6.1
On-time delivery	5.8
Machinablility	5.7
Moisture Content (MC)	5.6
Consistency of MC	5.6
Color	5.5
Price stability	5.5
Straightness	5.5
Blue/mineral stain-free	5.4
Order lead-time	5.2
Low price	5.0
Finishability	4.8
Wane-free	4.7
Mechanical properties	4.7
Lack of knots	4.5

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the market segment. Almost twenty-four percent of companies said they participated in some type of E-business. It should be noted that most of the responses to the question stated that a web site for advertising was what they were currently using. Participants were asked to please inform us of any new equipment or process which they may have installed at their facility within the past five years. Installation of more automated equipment was the most common response. This included the CNC machines along with computerized saws, sanders, and routers. This could allow them to use lesser-known species. Processing technology has come mainly in the form of inventory management. Many of

the respondents to this question stated that they have currently installed bar coding systems to better handle their products.

Production Scheduling

Production scheduling questions were also asked to gain a better understanding of how each market segment handles their manufacturing process. Figure 3.5 illustrates the three different types of scheduling options, plus a category for the respondent to fill in as other. The only respondent to fill out the other option stated that their company had their own product plan control. Both order expediting and MRP (material requirement plan) made up for 47.1% of the responses individually.

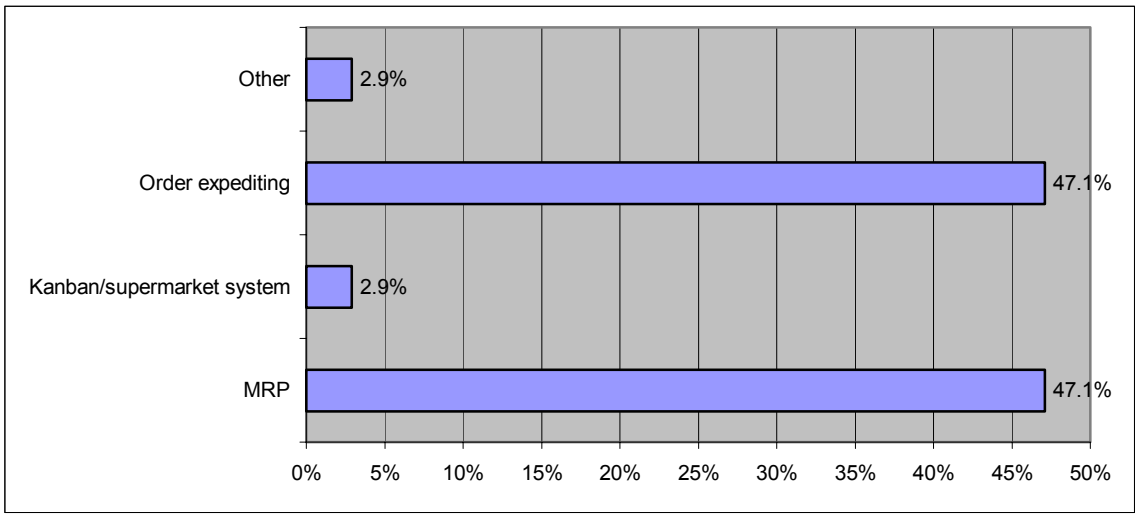

Figure 3.5: Percentage of respondents using different types of production scheduling.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 24.5 days. The production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 4.8, just above what would be thought of as average. With this being the

case it can be concluded that the average lead-time would vary even within each production facility.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow the respondent to voice his or her opinions on the use of "non-traditional" species. Many of the responses were similar. In the first question they were asked about potential barriers they may foresee in using these species. The main responses are summarized below.

- *Architects and designers will have to specify alternative species before we can produce a product*
- *Customer and consumer demand*
- *Machineablilty, staining properties, strength properties*
- *Market acceptance*
- *Not being pushed very hard by the marketing and sales force*
- *Supply of raw material*

These types of quotes indicate that companies are willing to work with the alternative species if there is a market for them. Companies are also interested in receiving more information on the attributes and supply chains of these species. The last question allowed the respondent to share anything they felt might be of interest to our study. The most common response to this question was that they are willing to use these species, but will need more information before doing so. Many respondents wrote that they would be interested in the information that will be obtained through this study.

Cabinets

Profile

The wood cabinet market segment returned 72 completed questionnaires. This resulted in a response rate of 18.1%. The regional distribution of the respondents within this market segment is shown in Figure 3.6.

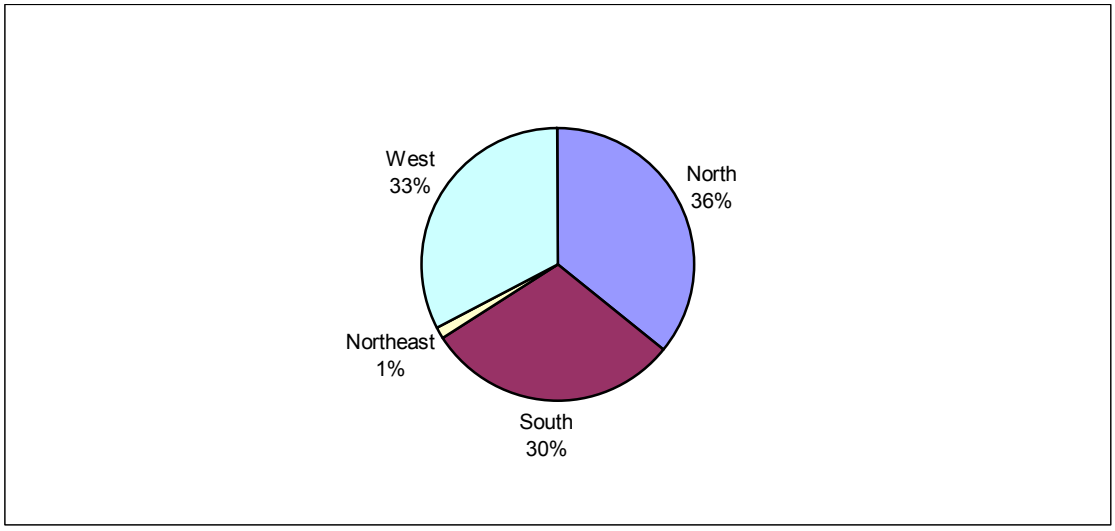

Figure 3.6: Cabinet manufacturer respondents by region.

Cabinet manufacturers were asked if they were a part of a multiple facility company or a single production facility. Within this segment 83.1% of the respondents were a part of a single operation. The Kitchen Cabinet Manufacturers Association (KCMA) and the American Woodworking Institute (AWI) were the trade associations with the most members answering the questionnaire, however only 46.4% of the respondents were members of any association. Because this study only targeted a sample population of companies with more than 20 employees, many of the smaller custom cabinet manufacturing companies were not participants within this survey. Yet, most of the respondents were still members of smaller facilities. Eighty percent of the

participating companies had less than 50 full-time employees working at the facility and only 10% had more than 300 employees.

Data on gross sales for the entire company were also gathered. As could be expected with many small companies, the majority of the respondents said that their company has less than $5,000,000 in sales volume (Table 3.9).

Table 3.9: Total gross sales the cabinet market segment.

	# of respondents	% of respondents
Less than $1,000,000	2	2.9
$1,000,001 - $5,000,000	40	57.1
$5,000,001 - $15,000,000	15	21.4
$15,000,001 - $25,000,000	3	4.3
$25,000,001 - $50,000,000	3	4.3
Greater than $50,000,000	7	10.0

Many of the respondent companies also produce other products besides cabinets (Table 3.10). Millwork was produced the most, with 31.9% of cabinet companies also manufacturing products for this segment.

Table 3.10: Percentage of respondent cabinet companies that also produce other products.

Dimension and Components	Flooring	Millwork	Office Furniture	Windows and Doors	Household Furniture	Other
8.3%	1.4%	31.9%	20.8%	5.6%	15.3%	1.4%

The particular type of cabinets a company was making was also of interest. The respondent was asked to choose one of three options that best described their company's product. The majority of the companies produce custom cabinets. It also needs to be noted that one respondent answered that they did not manufacture cabinets, but did however produce cabinet parts (Figure 3.7).

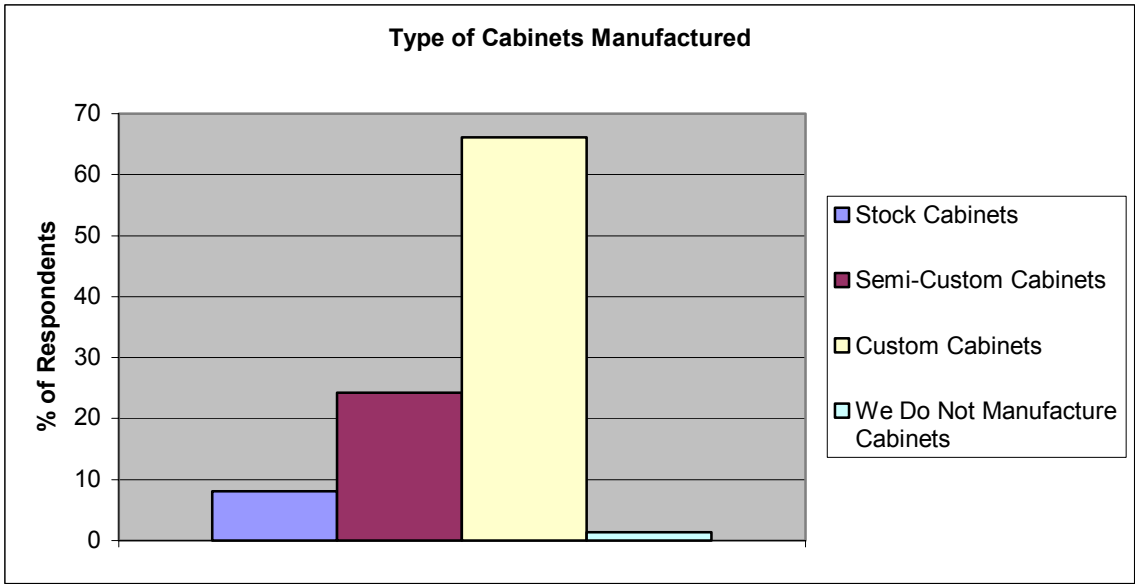

Figure 3.7: Type of cabinets produced by respondent companies.

Raw Material Use

The cabinet manufacturers' average wood raw material cost was calculated to be 34.2% of their total cost associated with doing business. The average annual lumber input volume at each production facility was calculated as 1.8 million board feet. This figure is considerably higher than board feet averages that were found in other studies that included the cabinet market segment. A possible reason for this higher average is three very large outliers that may have skewed this number up. When removed the mean decreases to 605,000. The lumber input was calculated for both hardwood and softwood. Hardwood accounts for over 1.7 million board feet, whereas softwood lumber is 161 thousand board feet. The grades of the lumber that were being used were also recorded. Table 3.11 contains data on the percent of each grade used. The most commonly used hardwood grade was No. 1 Common and the most commonly used softwood grades were #2 and #3.

Table 3.11: Average percentage use of the different grades of hardwood and softwood lumber in the cabinet market segment.

Hardwood	% Used	Softwood	% Used
FAS	9.7	Select	16.6
Selects	4.5	#1	2.5
No. 1 Common	69.3	#2	21.9
No. 2 Common	15.9	#3	36.2
#3A	0.8	Utility	3.5
#3B	0.0	Appearance	19.2

Information was gathered on species use within each market segment. The species that are being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their products. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list. Table 3.12 shows the average board footage use of each species. Red oak is the most commonly used species in this segment, approximately 47%. The cabinet segments "traditional" species were defined as red oak, hard maple, cherry, and soft maple. These four species accounted for 91.3% of all species used. The cabinet market segment has displayed that they use a few select species and that is all they are using. Hickory was the one "non-traditional" species that was being used substantially. The use of hickory in cabinets has started to become fashionable and this number will rise in the coming years. Many of the species currently being used in this segment that are not part of this list were reported to be walnut, beech, cedar, and mahogany.

Table 3.12: Average percentage and board footage of species use among cabinet manufacturers. *

Species	% Used	Board Feet in Thousands
Red Oak	47.2	921.2
White Oak	0.3	6.7
Hard Maple	23.2	453.6
Cherry	13.7	267.6
White Pine	0.8	15.3
Ponderosa Pine	0.3	5.7
Hickory	3.1	59.7
Ash	0.2	3.7
Soft Maple	7.2	141.3
Hybrid Poplar	0.1	2.9
Southern Yellow Pine	0.3	6.7
Radiata Pine	0.0	0.0
Douglas Fir	0.1	2.3
Yellow Birch	0.1	1.5
Yellow Poplar	0.4	8.1
Aspen	0.0	0.4
White Birch	1.0	19.3
Gum	0.0	0.0
Alder	1.0	20.5
Other	0.9	16.9

***Note – This is skewed high due to three large manufacturers.**

When asked about the major factors considered when a cabinet company decides on what species of wood to use, customer demand was filled out by over 93% of respondents. Cost of the species was also a filled out as a major factor by 18.3%, but it is clear that cabinet manufacturers use species that are specified by their customers.

Respondents were asked to estimate their usage of material other than solid lumber. The cabinet segment mainly used particleboard, hardwood plywood, and MDF (Figure 3.8). A question regarding component usage only was also included in the questionnaire. Forty-eight percent of the components being used were categorized as blanks. Blanks are considered to be unfinished components, which are not ready for assembly. The other two categories of components were finished and semi-finished.

These two options are only differentiated by their degree of value that has been added by the component manufacturer. Figure 3.9 displays the three categories of components and the average amounts of each being purchased by cabinet companies.

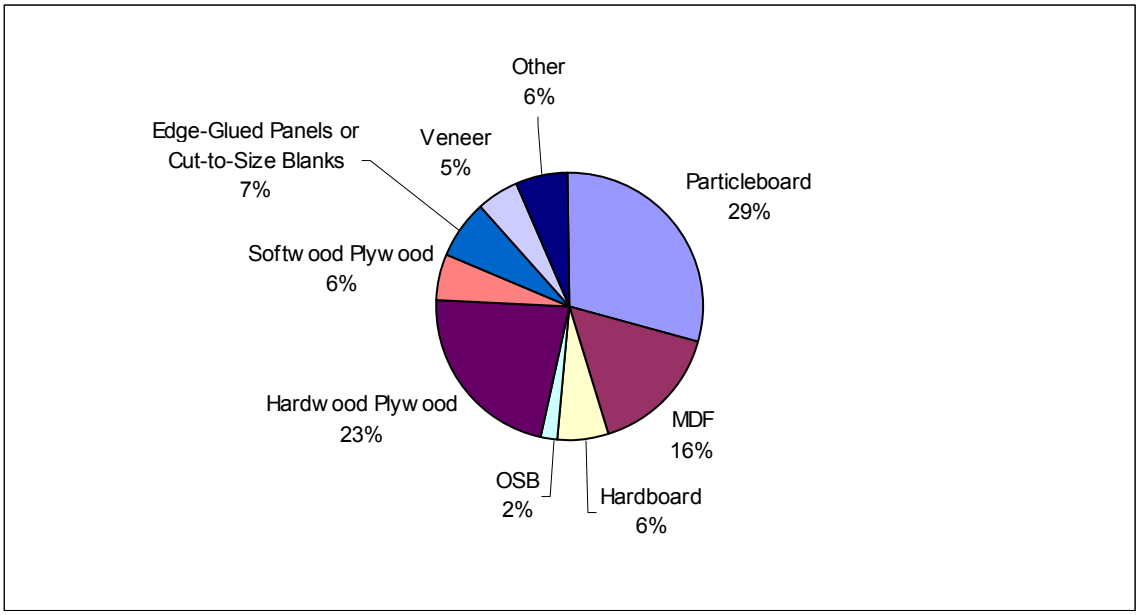

Figure 3.8: Material usage, excluding lumber, in the cabinet market segment.

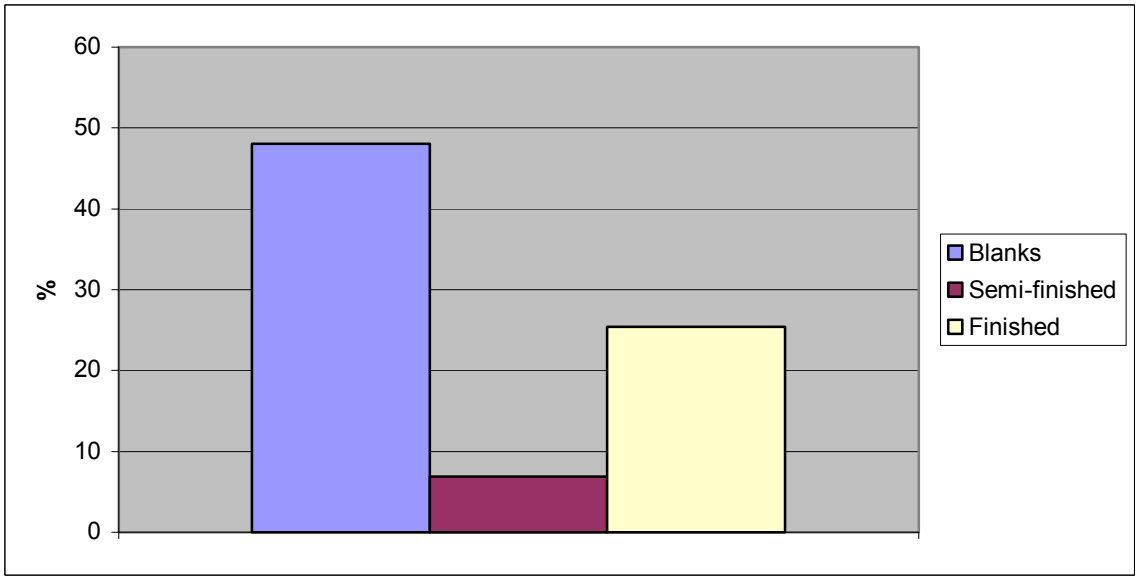

Figure 3.9: Mean percentages of components purchased by the cabinet market segment.

With certification becoming an important issue within the forest products industry, a question asked whether the respondent company was using certified raw

materials. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. Only three respondents answered that they were using certified materials. The two certifying agencies that were used were SFI and SmartWood. The question contained two other options, which were "No" and "Don't know". Forty-nine percent and 46.5% of the participants filled out these two options, respectively. This showed that almost one-half of the respondents did not know if their company used certified materials.

Outsourcing of component needs has become more popular in the secondary wood products industry. Within the cabinet market segment 18.5% of components were being outsourced. This displays that cabinet companies are still producing more of their wood parts than buying them from other companies.

Participants of the survey were asked to rate the importance of many material attributes they demand in the components/component supplier's product. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). Color and moisture content of the wood component was rated as the most important attribute to the cabinet segment. This segment does not focus on the mechanical properties as much as the visual qualities of their products (Table 3.13).

Respondents from the cabinet market segment were asked a second rating question that was based on the same seven-point scale. Service attributes concerning the purchase of wood components were addressed. Within these categories consistent supply, on-time delivery, and service rated higher than on average than price issues (Table 3.14).

Table 3.13: Mean rankings of important material attributes desired in wood component supplier's product by the cabinet segment.

Attribute	Mean
Color	6.1
Moisture Content (MC)	6.1
Consistency of MC	6.0
Straightness	5.9
Blue/mineral stain-free	5.8
Finishability	5.7
Lack of knots	5.6
Order lead-time	5.6
Wane-free	5.4
Machinability	5.3
Proper dimensions	5.2
Mechanical properties	4.9

Scale (1 = not important, 7 = very important)

Table 3.14: Mean rankings of important service attributes of the wood components purchased in the cabinet market segment.

Attribute	Mean
Consistent supply	6.3
On-time delivery	6.2
Service	6.1
Price stability	5.5
Low price	4.7

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the cabinet market segment. There were questions that dealt with the use of the Internet, new equipment, and new processes that the respondent's company may be using. Almost thirty-three percent of companies said they participated in some type of E-business. It should be noted that most of the responses to these questions stated that a web site for advertising was what they were currently using. Participants were asked to indicate any new equipment or processes, which they may have installed at their facility within the

past five years. Installation of more automated equipment was the most common response. This included CNC routers, panel saws, and point-to-point machines along with computerized saws, sanders. New technology is a predictor of proactive companies that may be willing to use new species. Processing technology has come mainly in the form of inventory management. Many of the respondents to this question stated that they have currently installed bar coding systems to better handle their products. Computer Aided Design (CAD) software was also indicated as a new process for many companies.

Production Scheduling

Production scheduling questions were also asked to gain a better understanding of how each market segment handles their manufacturing process. The first question dealt with what type of system they used to schedule production. Figure 3.10 displays the three different types of scheduling options, plus a category for the respondent to fill in as other. Order expediting accounted for 56.5% of all production scheduling in the cabinet market segment. The "Other" category was relatively large in this segment. Many of these companies were basing their production on customer demand.

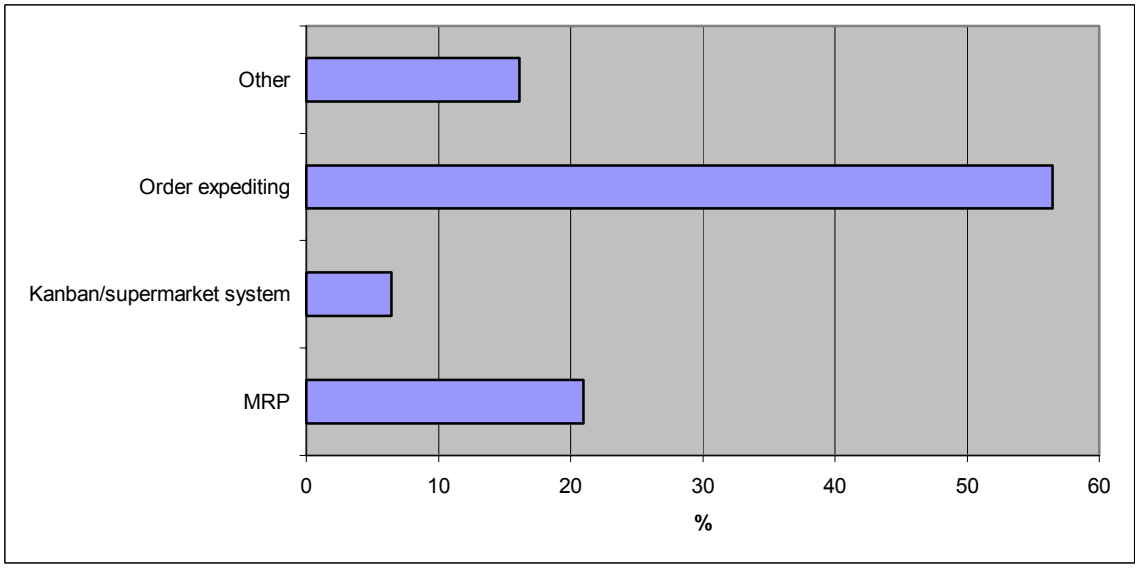

Figure 3.10: Percentage use of production scheduling by cabinet manufacturers.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 14.9 days. The production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 4.8, just above what would be thought of as average. With this being the case it can be concluded that the average lead-time would vary even within each production facility.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow for the respondent to voice his or her opinions on the use of "non-traditional" species. Many of the responses were similar. In the first question they were asked about potential barriers they may foresee in using these species. The main responses are summarized below.

- *Customers request the species to be used*
- *Market demand*
- *Color matching properties*
- *Market acceptance*
- *Supply of raw material*

The cabinet market segment is made up of many smaller companies that produce custom cabinets. Most of these companies manufacture their cabinets with the species that has been requested by the consumer. The cabinet market segment will have to have designers and consumers begin to demand the "non-traditional" species before this segment will be able to replace their current species mix. Companies are also interested

in receiving more information on the attributes and supply chains of these species. The last question allowed the respondent to share with us anything they felt might be of interest to our study. The most common response to this question was that they are willing to use these species, but will need more information before doing so. Many respondents wrote that they would be interested in the information that will be obtained through this study. They also added that there were no veneer products to go along with the solid lumber.

Flooring

Profile

The wood flooring market segment returned 39 completed questionnaires. This resulted in a response rate of 25.9%. The regional distribution of the respondents within this market segment is shown in Figure 3.11.

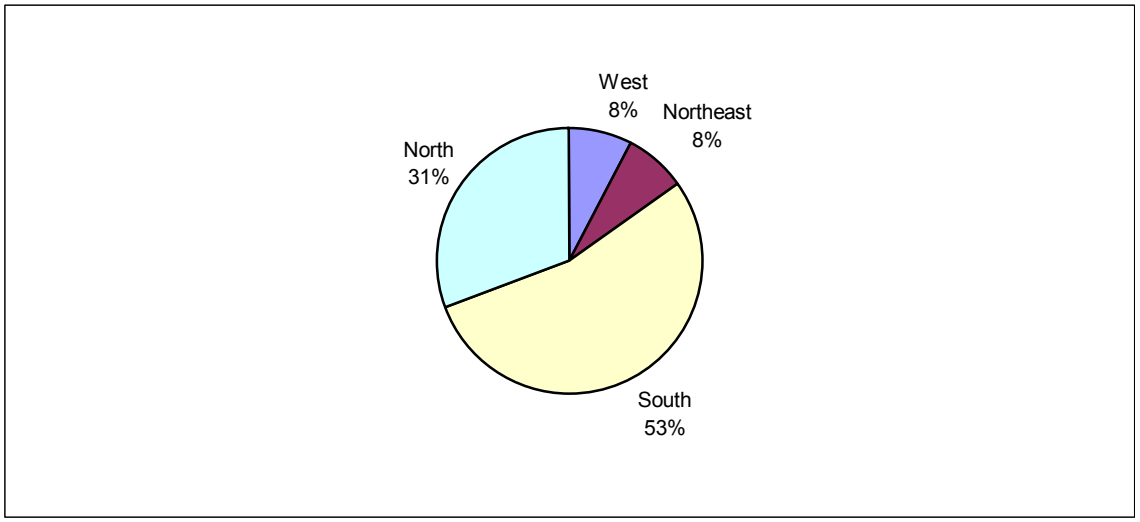

Figure 3.11: Flooring manufacturer respondents by region.

Flooring manufacturers were asked if they were a part of a multiple facility company or a single production facility. Within this market segment 68.4% of the respondents were part of a single operation. Nearly 90% of the flooring respondents

were members of a trade association. The National Wood Flooring Association (NWFA) was the most common response with The National Oak Flooring Manufacturers Association (NOFMA) also having a high response rate. The flooring segment is mainly made up of larger operations using a high amount of automation. Automation allows this segment to produce large amounts of their product with fewer employees. Thirty-one percent of participants in this survey had less than 25 employees working at their facility. The majority of the respondent companies had gross sales greater than 5 million dollars and yet only six facilities had over 200 full-time employees (Table 3.15).

Table 3.15: Total sales for flooring companies.

	# of respondents	% of respondents
Less than $1,000,000	6	15.8
$1,000,001 - $5,000,000	6	15.8
$5,000,001 - $15,000,000	12	31.6
$15,000,001 - $25,000,000	6	15.8
$25,000,001 - $50,000,000	1	2.6
Greater than $50,000,000	7	18.4

Other products were also being produced by many of the flooring companies. Dimension and component products were also being manufactured by 15.4% of the flooring respondents. Besides these six segments many companies also produced rough lumber and paneling (Table 3.16).

Table 3.16: Percentage of respondent flooring companies that also produce other products.

Dimension and Components	Cabinets	Millwork	Office Furniture	Windows and Doors	Household Furniture	Other
15.4%	5.1%	17.9%	0.0%	5.1%	2.6%	15.4%

The particular type of flooring a company was making was also of interest. The respondent was asked to report the percentages of three different types of flooring that are being produced at their facility. Eighty-seven percent of the flooring being produced was

solid hardwood flooring with solid softwood flooring and engineered flooring accounting for 3.8% and 8.8% of production respectively.

Raw Material Use

The flooring segment's average wood raw material cost was calculated to be 57.1% of their total cost associated with doing business. The average annual lumber input volume at each production facility was calculated to be 10.3 million board feet. The lumber input was also calculated separately for both hardwood and softwood lumber. Softwood lumber only accounts for approximately 150,000 board feet with the rest of the lumber being hardwood. Grades of the lumber that were being used were also recorded. Table 3.17 contains the percentage of each grade used. The flooring segment uses lower grades of lumber as a whole than most of the other wood products industries. This research found that most of the hardwood lumber being used was No. 2 Common and #3A. Softwood lumber has already been discussed as a very insignificant part of the flooring segment, but the grades that were used the most were also lower grades such as, #3 and Utility.

Table 3.17: Average use of the different grades of hardwood and softwood lumber within the flooring market segment.

Hardwood Grade	% Used	Softwood Grade	% Used
FAS	0.3	Select	5.8
Selects	0.0	#1	17.6
No. 1 Common	7.6	#2	3.4
No. 2 Common	62.4	#3	42.8
#3 A	26.0	Utility	30.4
#3 B	3.7	Appearance	0.0

Information was gathered on species of wood being used within each market segment. The type of species being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of

each species they use in their product. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list. Table 3.18 shows the average board footage use of each species. Oak is the predominate species used in flooring. For the flooring market segment only three species were defined as being "traditional." The species were red oak, white oak, and hard maple and they comprised 95% of the species mix. "Non-traditional species use was almost non-existent. Many of the respondents commented that most of the "non-traditional" species would be too "soft" to be used in flooring applications. Hickory was one "non-traditional" species that was used and it is a very "hard" and durable species. Many of the species that are currently being used in this market segment that are not part of this list were reported to be Walnut and Mesquite.

Table 3.18: Average percentage and volume of species use among flooring manufacturers.

Species	% Used	Board Feet in Thousands
Red Oak	68.0	6910.3
White Oak	18.1	1844.0
Hard Maple	8.9	907.8
Cherry	0.8	78.6
White Pine	0.1	8.4
Ponderosa Pine	0.0	0.8
Hickory	1.2	126.7
Ash	0.9	91.9
Soft Maple	0.1	13.1
Hybrid Poplar	0.0	0.0
Southern Yellow Pine	0.1	9.4
Radiata Pine	0.0	0.6
Douglas Fir	0.0	2.5
Yellow Birch	1.1	115.6
Yellow Poplar	0.0	2.4
Aspen	0.0	0.0
White Birch	0.0	0.0
Gum	0.0	0.1
Alder	0.0	0.0
Other	0.5	48.5

Customer demand was again the highest response when asked about the major factors considered when a flooring company decides on what species of wood to use, with 88.5% indicating this factor. Supply of the species was the next highest rated factor with 42.3% of respondents pointing to this factor. Cost, just like in other segments, was again not considered a major factor by most respondents in the flooring segment with only 34.6%.

Respondents were asked to estimate their usage of material other than solid lumber. Within the flooring market segment only a limited number of respondents used raw material that was not solid lumber. Figure 3.12 shows the break down of the products that are used within this segment, yet it should be noted that this is only a small proportion of the total raw material. The panel products that are used are being manufactured into engineered flooring options.

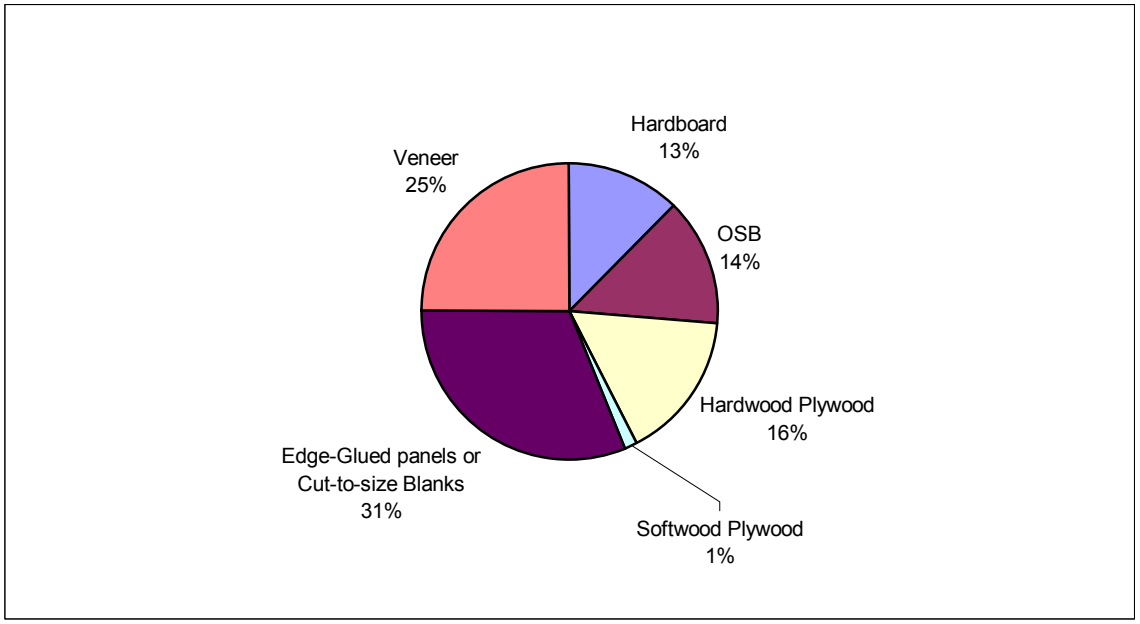

Figure 3.12: Material use, excluding lumber, in the flooring market segment.

Certification has become an important issue within the forest products industry. Only three respondents answered that they were using certified materials. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. The agencies and programs that are being used by the flooring market segment were reported to be FSC, SCS, and SmartWood. Figure 3.13 shows the percentage of flooring manufacturers who are participating in certification. Many respondents answered that they either did not know what certification is or they did not know if their company used any certified products.

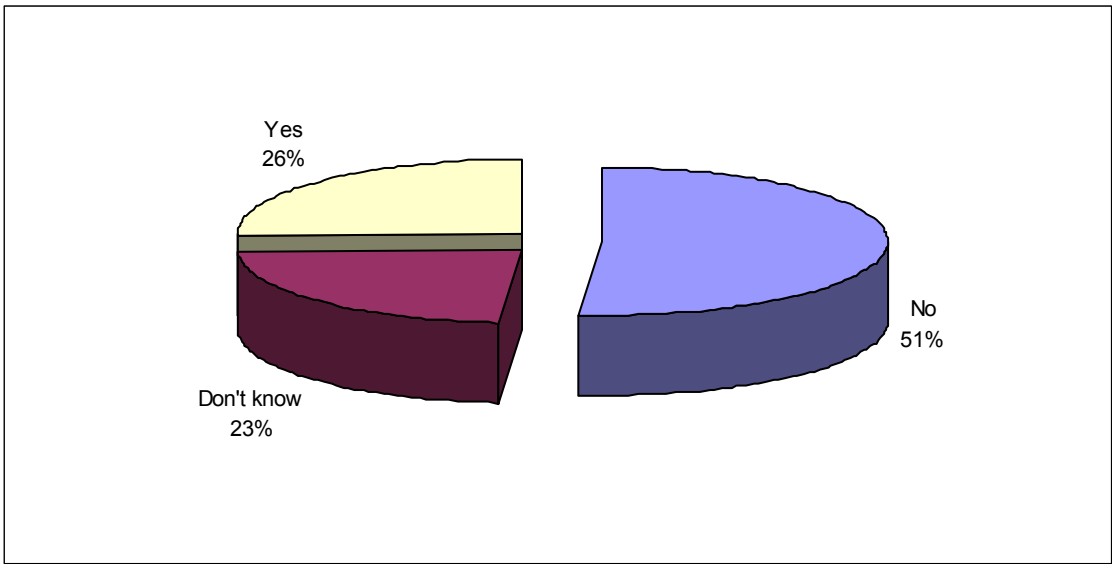

Figure 3.13: Response to the environmental certification use in the flooring segment.

Flooring manufacturers who participate in outsourcing of their wood component needs were relatively low, with only 20.6% being outsourced. This figure was expected, as there is less of a need by flooring manufacturers to purchase their wood components by comparison to the other segments.

Participants of the survey were asked to rate the importance of material attributes they demand in the components/component supplier's product. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). Moisture content

of the wood component was ranked as the most import attribute to the flooring market segment (Table 3.19). The segment deals with more of the lower grades of lumber, so it is not as important to them to have high quality components containing no knots and limited wane.

Table 3.19: Mean rankings of important material attributes desire in wood component supplier's product by the flooring market segment.

Attribute	Mean
Moisture Content (MC)	5.6
Consistency of MC	5.6
Order lead-time	5.5
Straightness	5.5
Machinability	5.4
Finishability	5.4
Blue/mineral stain	5.2
Mechanical properties	5.1
Color	5.1
Proper dimension	4.9
Wane-free	4.3
Lack of knots	3.9

Scale (1 = non important, 7 = very important)

Respondents from the flooring segment were asked a second rating question that was based on the same seven-point scale. The flooring segment was concerned mainly with price stability. Service is also an important factor to this market segment. The mean ratings are shown in Table 3.20.

Table 3.20: Mean rankings of important service attributes of the wood components purchased in the flooring market segment.

Attribute	Mean
Price stability	6.0
Service	5.9
Consistent supply	5.6
Low price	5.5
On-time delivery	5.4

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the flooring market segment. There were questions that dealt with the use of the Internet, new equipment, and new processes that the respondent's company may be using. Approximately 44% of the respondents said that their company uses some type of E-business. It again should be noted that most of the responses to this question stated that a web site for advertising was what they were currently using. Participants were asked to inform us of new equipment or processes which they may have installed at their facility within the past five years. Installation of more automated equipment was the most common response. Planers and gang rip saws were the most common response, with many companies also installing scanning machines. Most flooring companies had not updated their processes, but some respondents did say that they had installed new processes in the way that they finish much of their flooring line.

Production Scheduling

Production scheduling questions were asked to gain a better understanding of how each market segment handles their manufacturing process. Figure 3.14 illustrates the percentage of the three different types of scheduling options, plus a category for the respondent to fill in as other. Order expediting accounted for 38.9% of all production scheduling in the flooring segment. The other category was relatively large in this segment. The responses to the other category were mainly that they produce as much as they can, as fast as they can.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 52.6 days. The

production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 5. This market segment ranked their production as smoother than the other segments surveyed.

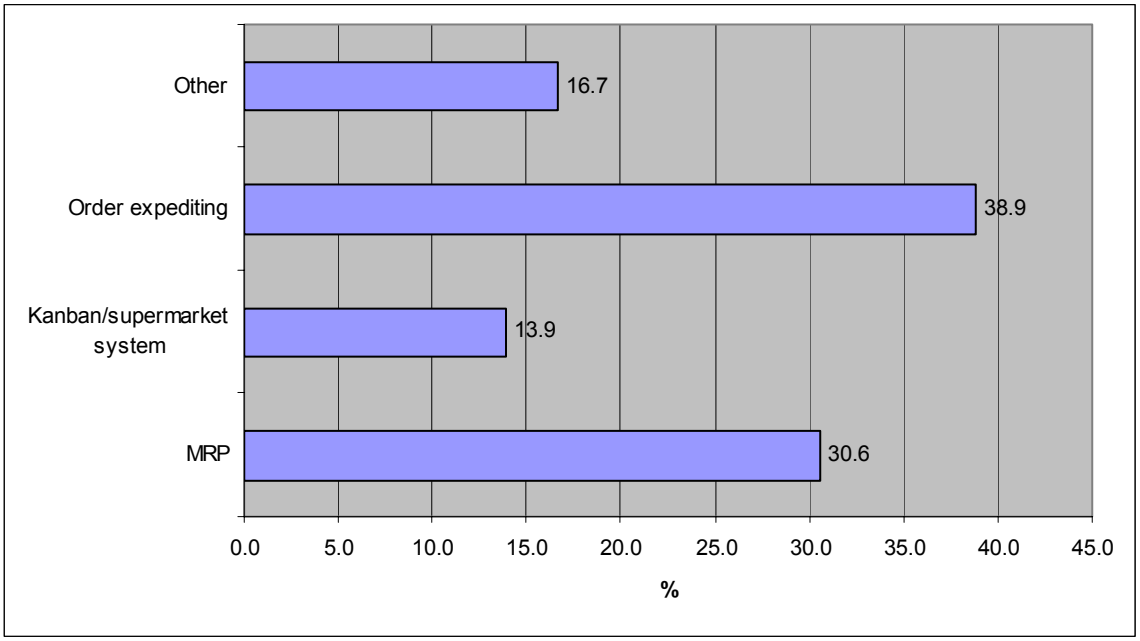

Figure 3.14: Flooring manufacturers use of different types of production scheduling.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow for the respondent to voice his or her opinions on the use of "non-traditional" species. Many of the responses were similar. In the first question they were asked about potential barriers they may foresee in using these species. The main responses are summarized below.

- *Consumers do not want to use a species they have not seen used before*
- *Tradesmen prefer using oak*
- *No market for products other than traditional species*
- *Consumer education is needed*

The last question allowed the respondent to share with us anything they felt might be of interest to our study. Many respondents stated that their company has attempted to use other species and has had minimal success. They also stated that there is a lack of older growth softwoods because of the paper company cutting the younger trees.

Millwork

Profile

The wood millwork market segment returned 79 completed questionnaires. This resulted in a response rate of 17.8%. The regional distribution of the respondents within this segment is shown in Figure 3.15.

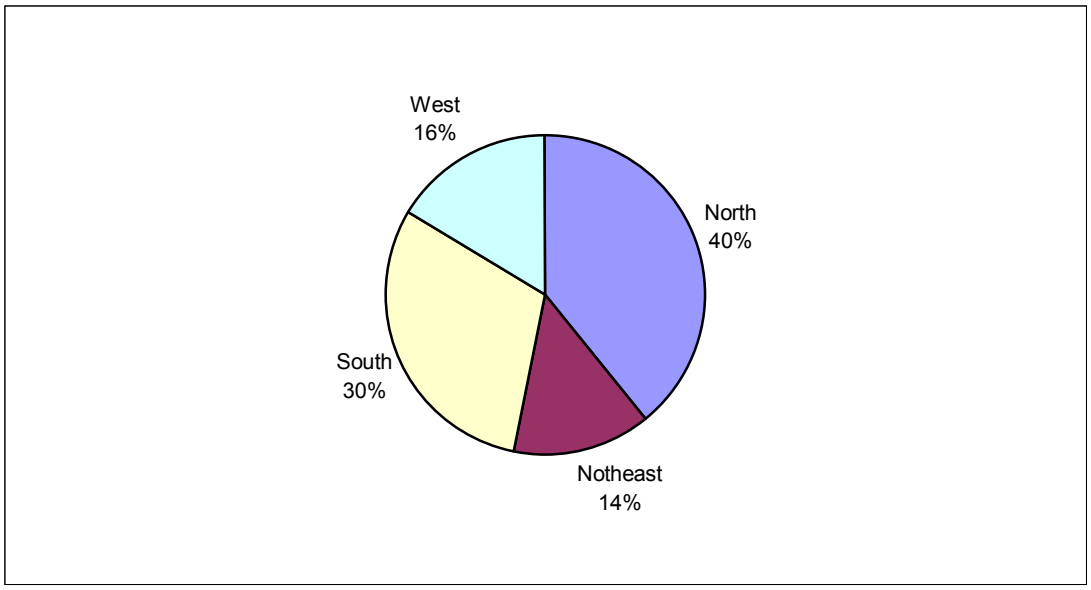

Figure 3.15: Millwork manufacturer respondents by region.

Millwork manufacturers were asked if they were a part of a multiple facility company or a single production facility. Within this market segment 78.5% of the respondents were a part of a single operation. Eighty percent of the millwork respondents stated that they were members of a trade association too. The American Woodworking Institute (AWI) was the trade association that millwork manufacturers

belonged. Approximately 62% of the respondents were from facilities that employed less than 50 full-time employees. Many of these companies stated that they had added a considerable amount of automated equipment, CNC machines, and no longer needed as many employees. There were three facilities that did employ over 200 people.

Data on gross sales for the companies were gathered. The majority of the millwork market segment had gross sales above 1 million dollars (Table 3.21).

Table 3.21: Total gross sales for the millwork market segment.

	# of respondents	% of respondents
Less than $1,000,000	2	2.9
$1,000,001 - $5,000,000	40	57.1
$5,000,001 - $15,000,000	15	21.4
$15,000,001 - $25,000,000	3	4.3
$25,000,001 - $50,000,000	3	4.3
Greater than $50,000,000	7	10.0

Many of the respondent companies also produce other products besides millwork (Table 3.22). Over 30% of millwork manufacturers also produce cabinets and windows and doors.

Table 3.22: Percentage of millwork companies that also produce other products.

Dimension and Components	Flooring	Cabinets	Office Furniture	Windows and Doors	Household Furniture	Other
13.9%	19.0%	36.7%	21.5%	32.9%	2.5%	0.0%

The particular type of millwork a company was making was also of interest. The respondent was asked to choose one of three options that best described their company's product. The majority of the millwork respondents stated they produce moulding and trim. Respondents that chose the "other" option mainly wrote in that they produce casegoods and architectural millwork (Figure 3.16).

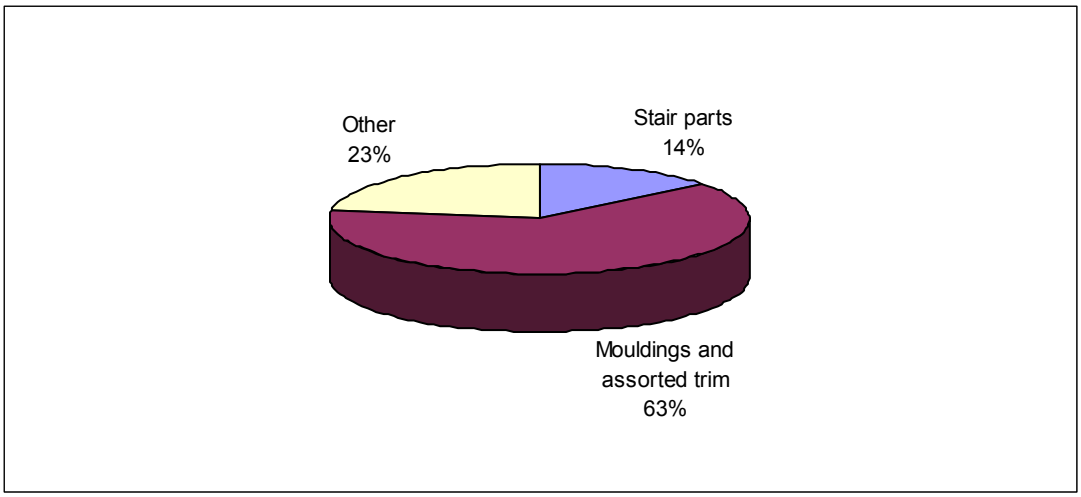

Figure 3.16: Type of millwork produced by respondent companies.

Raw Material Use

The millwork market segment's average wood raw material cost was calculated to be 38.5% of their total cost associated with doing business. The average annual lumber input volume at each production facility was calculated to be 2.8 million board feet. The lumber input was also calculated for both hardwood and softwood. Hardwood accounted over 1.5 million board feet and softwood lumber was about equal at 1.3 million board feet. The grades of the lumber that were being used were also recorded (Table 3.23). The millwork segment uses higher grades of hardwood lumber. The two most popular grades used were FAS and No. 1 Common. Softwood grades that were used the most were lower grades consisting of mainly #3 and Appearance.

Table 3.23: Average use of the different grades of hardwood and softwood lumber within the millwork market segment.

Hardwood Grade	% Used	Softwood Grade	% Used
FAS	63.4	Select	15.0
Selects	3.9	#1	0.2
No. 1 Common	26.3	#2	8.6
No. 2 Common	6.4	#3	54.5
#3A	0.1	Utility	2.9
#3B	0.0	Appearance	18.6

Information was gathered on what species of wood are being used within each market segment. The type of species being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their product. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list. Table 3.24 shows the average board footage use of each species. The millwork used a wide variety of species. "Traditional" species were defined as red oak, ponderosa pine, radiata pine, and yellow poplar. These species accounted for 81.2% of the species mix. The millwork market segment displays an opportunity for the use of "non-traditional species. This segment currently uses a wide variety of species in a wide variety of applications. Because the millwork segment is so diverse in the type of products that are produced, different species can be used in place of the "traditional" ones. Many of the species that are currently being used in this market segment that are not part of this list were reported to be mahogany, walnut, and cypress.

Respondents were asked what are the major factors considered when a millwork company chooses a species to use. Just like many of the other market segments customer demand was chosen by a vast majority of the respondents. Cost of the species was reported to be a major factor by 36.8% and ease of use was also chosen by 16.2% of the companies.

Table 3.24: Average percentage and volume of species use among millwork manufacturers.

Species	% Used	Board Feet in Thousands
Red Oak	26.3	849.3
White Oak	0.7	22.6
Hard Maple	1.7	54.3
Cherry	1.0	33.8
White Pine	1.0	33.3
Ponderosa Pine	21.0	678.0
Hickory	0.3	10.0
Ash	0.3	9.1
Soft Maple	1.6	51.4
Hybrid Poplar	0.3	9.5
Southern Yellow Pine	0.2	6.4
Radiata Pine	14.8	478.5
Douglas Fir	4.9	157.5
Yellow Birch	0.4	12.0
Yellow Poplar	19.1	616.4
Aspen	0.5	17.2
White Birch	0.2	5.1
Gum	0.0	0.3
Alder	0.3	9.4
Other	5.3	169.9

Respondents were asked to estimate their usage of material other than solid lumber (Figure 3.17). The millwork market segment used a wide variety of panel products. Melamine was the main answer that was filled in as "Other." Wood component usage was also asked. Forty-nine percent of the components being used were categorized as blanks. Blanks are considered to be unfinished components, which are not ready for assembly. The other two categories of components were finished and semi-finished. These two options are only differentiated by their degree of value-added by the component manufacturer (Figure 3.18).

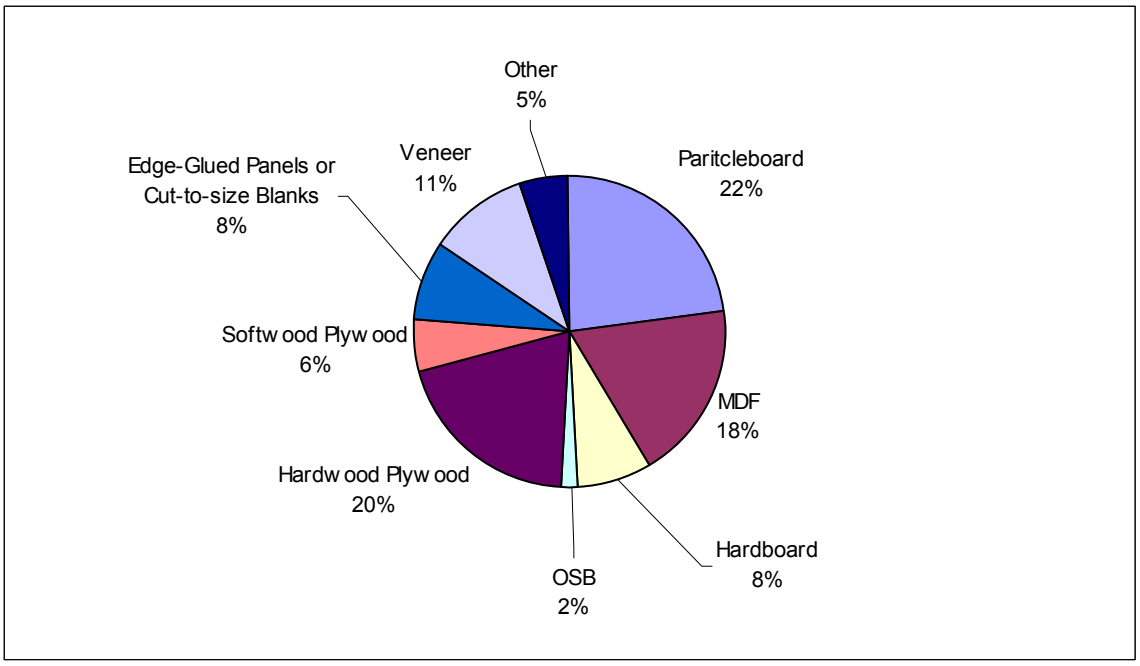

Figure 3.17: Material use, excluding lumber, in the millwork market segment.

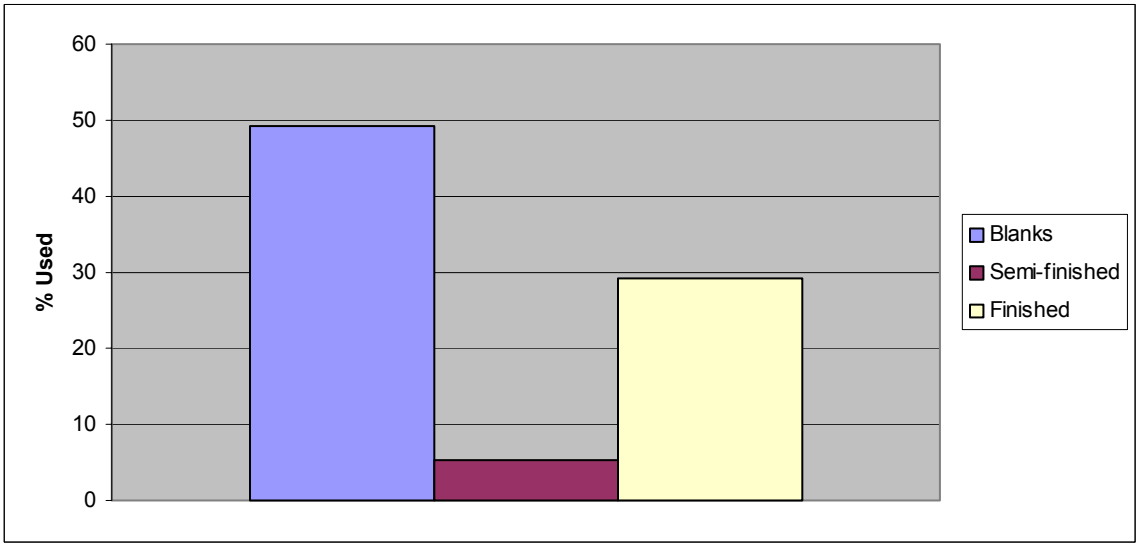

Figure 3.18: Mean percentages of components purchased by the millwork segment.

With certification becoming an important issue within the forest products industry, a question asked about whether the respondent company was using certified raw materials. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. Approximately 17% of respondent companies were using certified raw material. The agencies they were using included SFI

and FSC. The question contained two other options, which were "No" and "Don't know". Fifty percent and 36.9% of the participants filled out these two options, respectively.

Outsourcing of component needs has become more popular in the secondary wood products industry. Within the millwork market segment 22.8% of components were being outsourced.

Participants of the survey were asked to rate the importance of many material attributes they demand in their components/component supplier's product. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). Moisture Content (MC) and Consistency of MC again had the highest mean scores of any attribute (Table 3.25).

Table 3.25: Mean rankings of important material attributes desired in wood component supplier's product by the millwork market segment.

Attribute	Mean
Moisture Content (MC)	6.3
Consistency of MC	6.2
Straightness	5.9
Lack of knots	5.9
Proper dimension	5.7
Blue/mineral stain-free	5.6
Machinablity	5.5
Order time	5.5
Finishablity	5.5
Wane-free	5.4
Color	5.3
Mechanical properties	5.2

Scale (1 = not important, 7 = very important)

Respondents from the millwork market segment were asked a second rating question on service attributes that were based on the same seven-point scale. The

millwork market segment ranked consistent supply and service as the most important attributes when they purchase wood components (Table 3.26).

Table 3.26: Mean rankings of important service attributes of the wood components purchased in the millwork market segment.

Attribute	Mean
Consistent supply	6.1
Service	6.1
On-time delivery	5.9
Price stability	5.5
Low price	5.0

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the millwork segment. There were questions that dealt with the use of the Internet, new equipment, and new processes that the respondent's company may be using. Twenty-seven percent of respondents said that their company was involved in E-business. The most consistent written in answer to this question was again the use of a web site. Participants were asked to please inform us of any new equipment or process which they may have installed at their facility within the past five years. CNC equipment of all kinds was the most recorded answer. Optimizing equipment was also noted often among the millwork companies. Inventory management was the process that most companies had updated by adding bar code tracking and computer software that allowed them to better control their product flow. Computer Aided Design (CAD) software was also indicated as a new process for many companies.

Production Scheduling

Production scheduling was asked to gain a better understanding of how each segment handles their manufacturing process. The first question dealt with the type of system they used to schedule production. Order expediting was the number one response with 57.7% of companies using this system. The MRP system was used by 22.5% of the companies and only two respondents noted that they used the Kanban/Supermarket system. Respondents that did not use one of these three systems responded mainly by saying that they schedule production as orders are received.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 16.4 days. The production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 4.3, just above what would be thought of as average. With this being the case it can be concluded that the average lead-time would vary even within each production facility.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow for the respondent to voice their opinions on the use of "non-traditional" species. Many of the responses were similar. They were asked about potential barriers they may foresee in using these species. The main responses are summarized below.

- *Architects and designers will have to specify*
- *Market demand*
- *Need consistent supply*

- *No grading standards*
- *Consumer acceptance*
- *Could make it, but can't sell it*

The millwork market segment is one that is driven by designers and architects. The person who designed the application of the millwork specifies most of their species usage. Respondents were asked to share with us anything they felt might be of interest to our study. Many respondents noted that their smaller companies do not have control of the market and have to keep their product lines "in-style." Some also stated that information would need to be distributed to designers before any change can be made.

Office Furniture

Profile

The wood office furniture market segment returned 37 completed questionnaires. This resulted in a response rate of 18.4%. The regional distribution of the respondents within this market segment is shown in Figure 3.19.

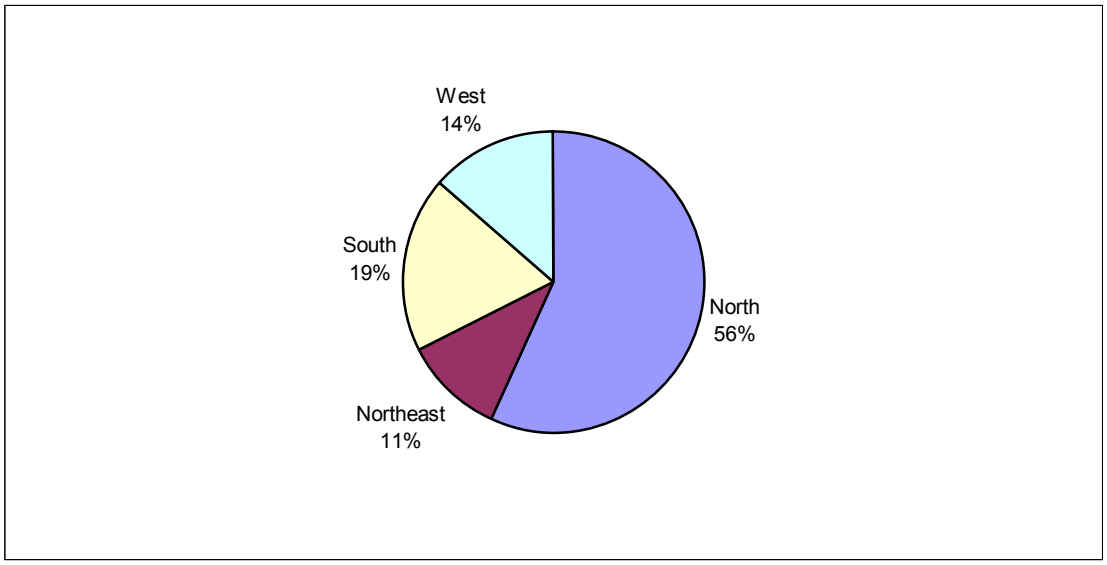

Figure 3.19: Office furniture manufacturer respondents by region.

Office furniture manufacturers were asked if they were a part of a multiple facility company or a single production facility. Thirty-five percent of the respondents were part of companies that had multiple facilities. Trade associations that respondents were part of mainly consisted of the American Furniture Manufacturers Association (AFMA) and Business and Institutional Furniture Manufacturers Association (BIFMA). Approximately one-half of the respondent companies were participants in a trade association.

Most respondent office furniture companies employ less than 50 people at their facilities (Figure 3.20). Data on gross sales for the entire company were also gathered (Table 3.27). Thirty-five percent of this market segment had sales less than $5 million.

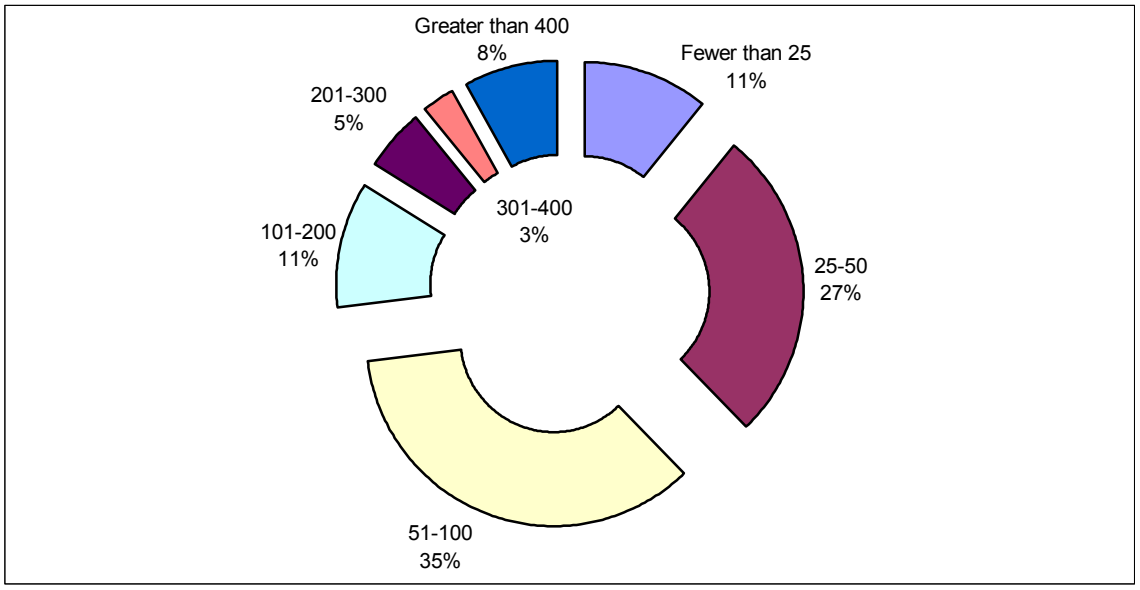

Figure 3.20: Employment per facility within the office furniture market segment.

Table 3.27: Total sales for office furniture companies.

	# of respondents	% of respondents
$1,000,001 - $5,000,000	13	35.1
$5,000,001 - $15,000,000	9	24.3
$15,000,001 - $25,000,000	7	18.9
$25,000,001 - $50,000,000	2	5.4
Greater than $50,000,000	6	16.2

Many companies also produce other products besides office furniture (Table 3.28). Only 2.7% of office furniture companies are producing household furniture.

Table 3.28: Percentage of office furniture companies that also produce other products.

Dimension and Components	Flooring	Millwork	Cabinets	Windows and Doors	Household Furniture	Other
16.2%	0.0%	5.4%	21.6%	0.0%	2.7%	2.7%

Raw Material Use

The office furniture market segment's average wood raw material cost was calculated to be 30% of their total cost associated with doing business. The average annual lumber input volume at each production facility was calculated at 350,000 board feet. This figure shows that most of the respondents were associated with smaller facilities. The lumber input was calculated for both hardwood and softwood. Hardwood lumber is the main solid raw material used with only four companies using softwood lumber in any amount. The grades of the lumber that were being used were also recorded (Table 3.29).

Table 3.29: Average use of the different grades of hardwood and softwood lumber by the office furniture market segment.

Hardwood Grade	% Used	Softwood Grade	% Used
FAS	8.6	Select	44.2
Selects	47.9	#1	35.3
No. 1 Common	39.0	#2	0.0
No. 2 Common	4.5	#3	0.0
#3A	0.0	Utility	20.6
#3B	0.0	Appearance	0.0

Information was gathered on what species of wood are being used within each market segment. The type of species being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their product. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list (Table 3.30). Red oak is the most commonly used species with 31.5% of the species mix. "Traditional" species composed 77.5% of the species mix. These species were defined as red oak, hard maple, cherry, and soft maple for the office furniture segment. Yellow poplar is one species that could be used more by this segment. Currently the household furniture segment is using yellow poplar for many applications and is considered to be "traditional" for that segment. Many of the species that are currently being used in this market segment that are not part of this list were reported to be mahogany, walnut, and basswood.

Table 3.30: Average percentage and volume of species use among office furniture manufacturers.

Species	% Used	Board Feet in Thousands
Red Oak	31.5	83.8
White Oak	0.8	2.2
Hard Maple	15.6	41.7
Cherry	11.0	29.4
White Pine	0.0	0.0
Ponderosa Pine	0.0	0.0
Hickory	0.0	0.0
Ash	4.9	13.0
Soft Maple	19.4	51.8
Hybrid Poplar	0.2	0.6
Southern Yellow Pine	0.0	0.0
Radiata Pine	0.0	0.0
Douglas Fir	0.0	0.0
Yellow Birch	2.3	6.2
Yellow Poplar	3.2	8.6
Aspen	0.2	0.6
White Birch	0.0	0.1
Gum	0.1	0.2
Alder	2.8	7.4
Other	7.8	20.9

When asked about the major factors considered when an office furniture company decides on what species of wood to use, customer demand was filled out by over 81%. This market segment also found cost to be a major factor. One-half of the respondents indicated cost as one of their major factors.

Respondents were asked to estimate their usage of material other than solid lumber. MDF and particleboard were the most used panel products (Figure 3.21). The question had three categories of wood components. Blanks are considered to be unfinished components, which are not ready for assembly. The other two categories of components were finished and semi-finished. These two options are only differentiated by their degree of value that has been added by the component manufacturer (Figure

3.22). Un-finished blanks are the most commonly used wood component. Manufacturers of office furniture are choosing to finish their products on site.

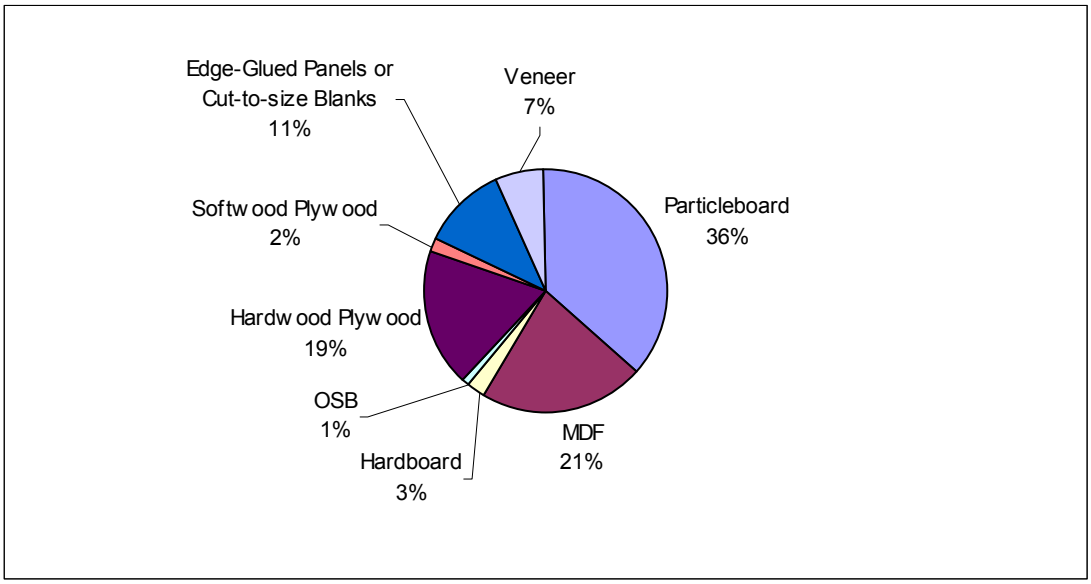

Figure 3.21: Material use, excluding lumber, in the office furniture market segment.

With certification becoming an important issue within the forest products industry, we asked about whether the respondent company was using certified raw materials. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. Only four respondents answered that they were using certified materials. The question contained two other options, which were "No" and "Don't know". Forty-seven percent and 41.7% of the participants filled out these two options, respectively. This showed that almost half of the respondents did not know if their company used certified materials and did not know what certified products are.

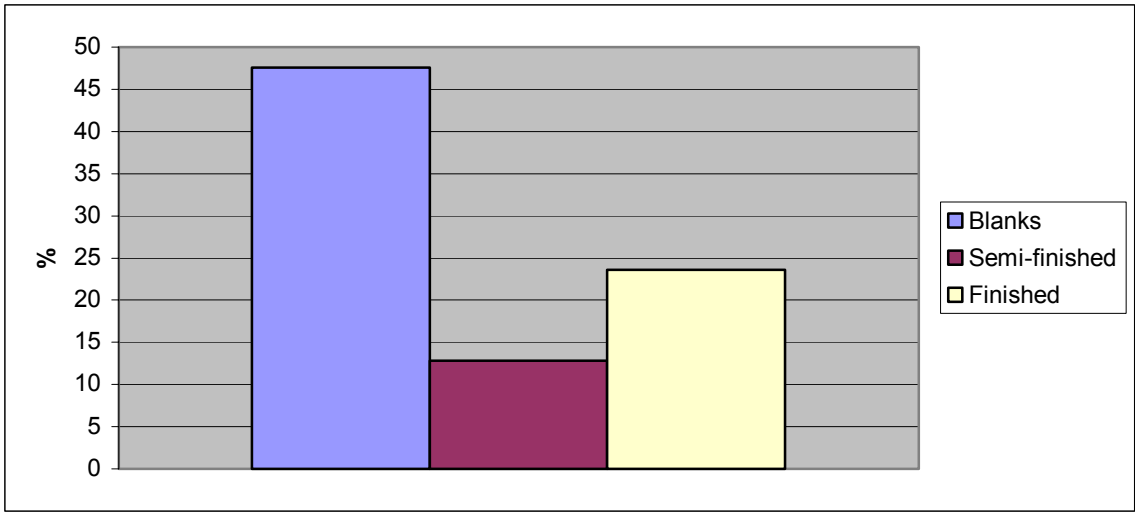

Figure 3.22: Mean percentages of components purchased for the office furniture segment.

Outsourcing of component needs has become more popular in the secondary wood products industry. Within the office furniture market segment 23.1% of components were being outsourced. The rest of the wood components that are being used are being produced in-house.

Participants of the survey were asked to rate the importance of many material attributes they demand in the components/component supplier's product. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). The office furniture segment ranked finishability and moisture content (MC) as the most important attributes they desired from their component suppliers (Table 3.31).

Respondents were asked a second rating question on service attributes that was based on the same seven-point scale (Table 3.32). Consistent supply was rated the most important of the five attributes.

Table 3.31: Mean rankings of important material attributes desired from wood component supplier by the office furniture market segment.

Attributes	Mean
Finishability	6.1
Moisture Content (MC)	6.1
Consistency of MC	5.9
Color	5.7
Blue/mineral stain-free	5.7
Lack of knots	5.7
Machinablity	5.6
Proper dimensions	5.6
Straightness	5.5
Wane-free	5.4
Order lead-time	5.4
Mechanical properties	5.0

Scale (1 = not important, 7 = very important)

Table 3.32: Mean rankings of important service attributes of the wood components purchased in the office furniture market segment.

Attributes	Mean
Consistent supply	6.1
Service	6.0
On-time delivery	5.9
Price stability	5.5
Low price	5.3

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the office furniture market segment. Thirty-four percent of companies said they participate in some type of E-business. The majority of these respondents were using a web site for advertising their company. Participants were asked to please inform us of any new equipment or process which they may have installed at their facility within the past five years. Installation of more automated equipment was the most common response. CNC machining equipment was pointed out as new equipment that most respondents had

installed. New technology is a predictor of proactive companies that may be willing to use new species. Processing technology was reported in the form of computer software and cutting bill optimization. Other companies had updated their inventory management by the use of bar coding systems.

Production Scheduling

Production scheduling was also asked to gain a better understanding of how each market segment handles their manufacturing process. Figure 3.23 displays the three different types of scheduling options, plus a category for the respondent to fill in as other. Order expediting accounted for 47.1% of all production scheduling in the office furniture segment.

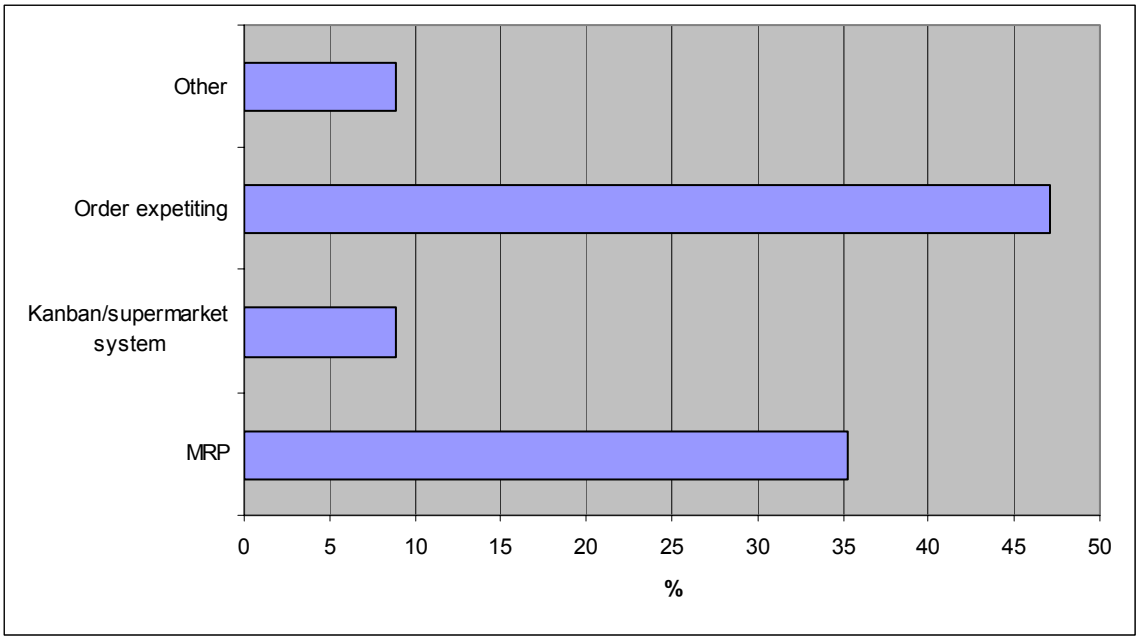

Figure 3.23: Percentage of respondents using different types of production scheduling.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 15.6 days. The production flow within the respondents company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular

question was 4.1, just above what would be thought of as average. With this being the case it can be concluded that the average lead-time would vary even within each production facility.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow for the respondent to voice his or her opinions on the use of "non-traditional" species. Many of the responses were similar in nature on the potential barriers they may foresee in using these species. The main responses were:

- *Finishability*
- *Color matching properties*
- *Consumer acceptance*

The respondents were also allowed to add anything they felt might be relative to this research. Within this segment there were no responses to this question that would be of interest to this research.

Windows and Doors

Profile

The wood windows and doors market segment returned 36 completed questionnaires (response rate 9.2%). The regional distribution of the respondents within this market segment is shown in Figure 3.24.

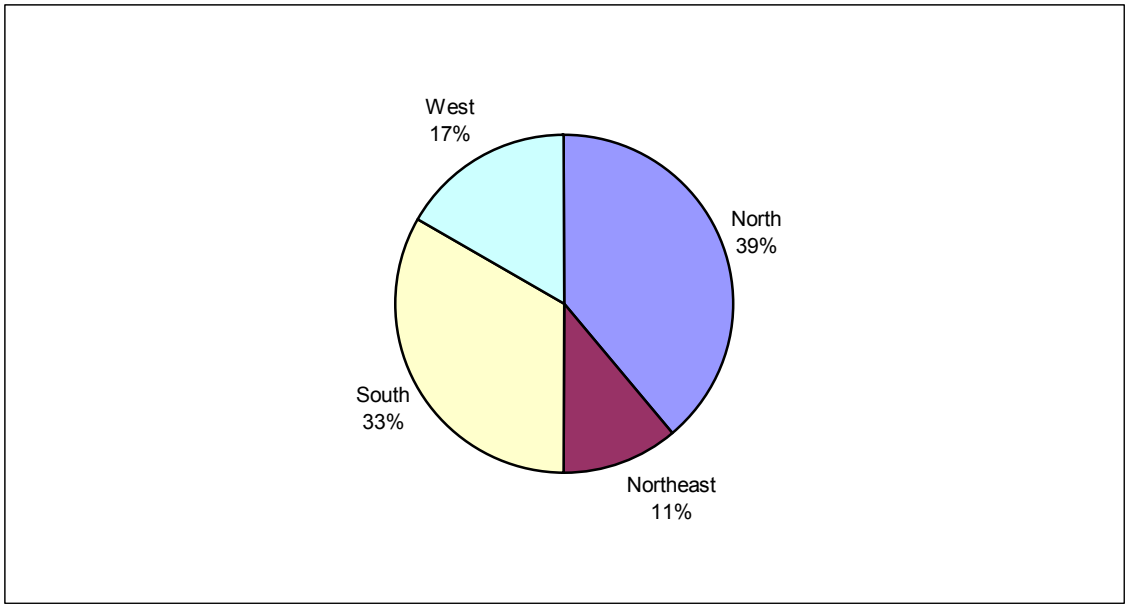

Figure 3.24: Windows and doors manufacturer respondents by region.

Windows and doors manufacturers were asked if they were a part of a multiple facility company or a single production facility. Within this market segment 66.7% of the respondents were a part of a single operation. Trade associations are a very important part of the secondary wood products industry. Sixty-five percent of window and door manufacturers are members of a trade association. The trade associations that the respondents were involved in most commonly were the National Sash/Door Jobber's Association (NSDJA) and or the North American Home Builders Association (NAHB).

Respondents were asked how many full-time employees their company had at this production facility. Seventy-seven percent of respondents in this market segment had less than 100 employees. Data on gross sales for the entire company were also gathered (Table 3.33). Many of the respondent companies also produce other products besides windows and doors (Table 3.34). Windows and doors manufacturers mainly engaged in the production of millwork as a second product.

Table 3.33: Total sales for windows and doors companies.

	# of respondents	% of respondents
$1,000,001 - $5,000,000	13	39.4
$5,000,001 - $15,000,000	9	27.3
$15,000,001 - $25,000,000	1	3.0
$25,000,001 - $50,000,000	4	12.1
Greater than $50,000,000	6	18.2

Table 3.34: Percentage of window and door companies that also produce other products.

Dimension and Components	Flooring	Millwork	Office Furniture	Cabinets	Household Furniture	Other
8.3%	5.6%	33.3%	5.6%	11.1%	5.6%	5.6%

Raw Material Use

The wood windows and doors market segment's average wood raw material cost was calculated to be 37.3% of their total cost associated with doing business. The average annual lumber input volume at each production facility was calculated to be 1.1 million board feet. The lumber input was also calculated for both hardwood and softwood. Hardwood accounts for over approximately 800 thousand board feet, whereas softwood lumber is around 300 thousand board feet. The grades of the lumber that were being used were also recorded (Table 3.35). The windows and doors segment uses mainly high-grade lumber, which consists of 91% of Selects and better.

Table 3.35: Average use of the different grades of hardwood and softwood lumber in the window and door market segment.

Hardwood Grade	% Used	Softwood Grade	% Used
FAS	72.9	Select	57.3
Selects	18.1	#1	17.1
No. 1 Common	7.6	#2	12.3
No. 2 Common	1.4	#3	12.0
#3A	0.0	Utility	0.0
#3B	0.0	Appearance	1.3

Information was gathered on the species of wood being used within each market segment. The type of species currently being used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their product. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list. Table 3.3 shows the average board footage use of each species. Hard maple is the most commonly used species with approximately 43% of the lumber in this market segment. "Traditional" species composed 83.7% of all wood used by the segment. "Traditional" species included red oak, hard maple, white pine, cherry, and ponderosa pine. Yellow birch and hickory were the two most used "non-traditional" species being used by the windows and doors segment. Many of the species that are currently being used in this segment that are not part of this list were reported to be redwood, cedar, and mahogany.

When asked a about the major factors considered when a windows and doors company decides on what species of wood to use, customer demand was answered over 86% and cost was indicated by 44.4%, making these two factors the most important to manufacturers when choosing a species.

Table 3.36: Average percentage and mean lumber use of species use among windows and doors manufacturers.

Species	% Used	Board Feet in Thousands
Red Oak	8.4	108.3
White Oak	0.2	2.1
Hard Maple	42.9	550.3
Cherry	14.5	186.0
White Pine	7.3	93.2
Ponderosa Pine	10.6	136.6
Hickory	3.6	46.1
Ash	0.1	0.7
Soft Maple	0.6	7.9
Hybrid Poplar	0.2	2.7
Southern Yellow Pine	0.8	10.1
Radiata Pine	2.1	27.1
Douglas Fir	1.2	14.8
Yellow Birch	3.6	45.6
Yellow Poplar	0.6	8.1
Aspen	0.0	0.0
White Birch	0.1	1.3
Gum	0.0	0.0
Alder	0.0	0.5
Other	3.3	41.9

Respondents were asked to estimate their usage of material other than solid lumber (Figure 3.25). Participants were then asked to report on their component usage only. Fifty-nine percent of the components being used were categorized as blanks. Blanks are considered to be unfinished components, which are not ready for assembly. The other two categories of components were finished and semi-finished. These two options are only differentiated by their degree of value that has been added by the component manufacturer (Figure 3.26).

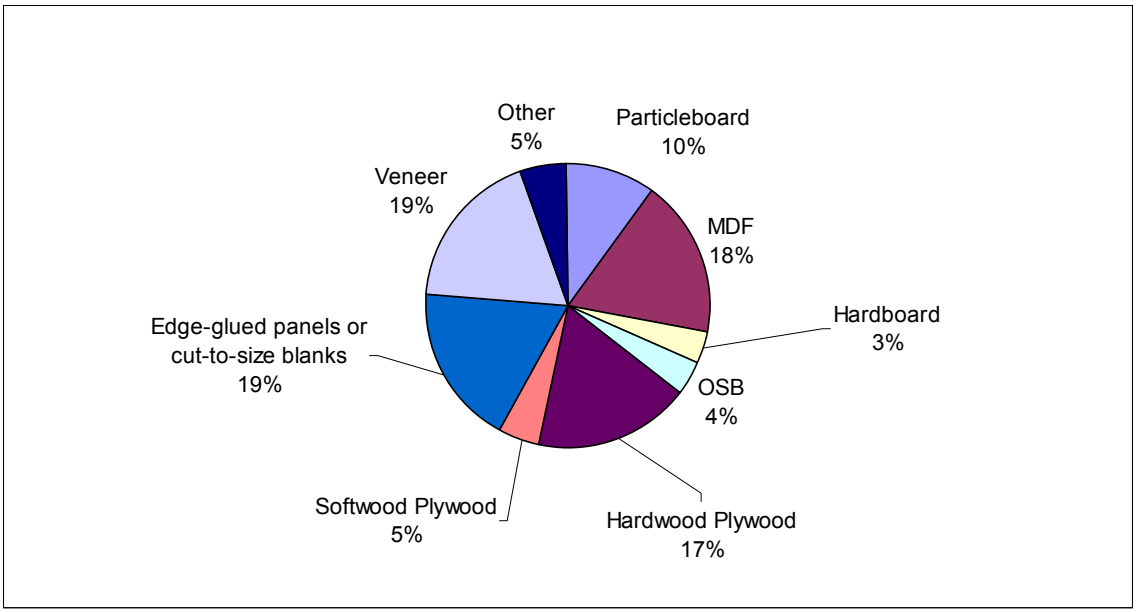

Figure 3.25: Material use, excluding lumber, in the windows and doors market segment.

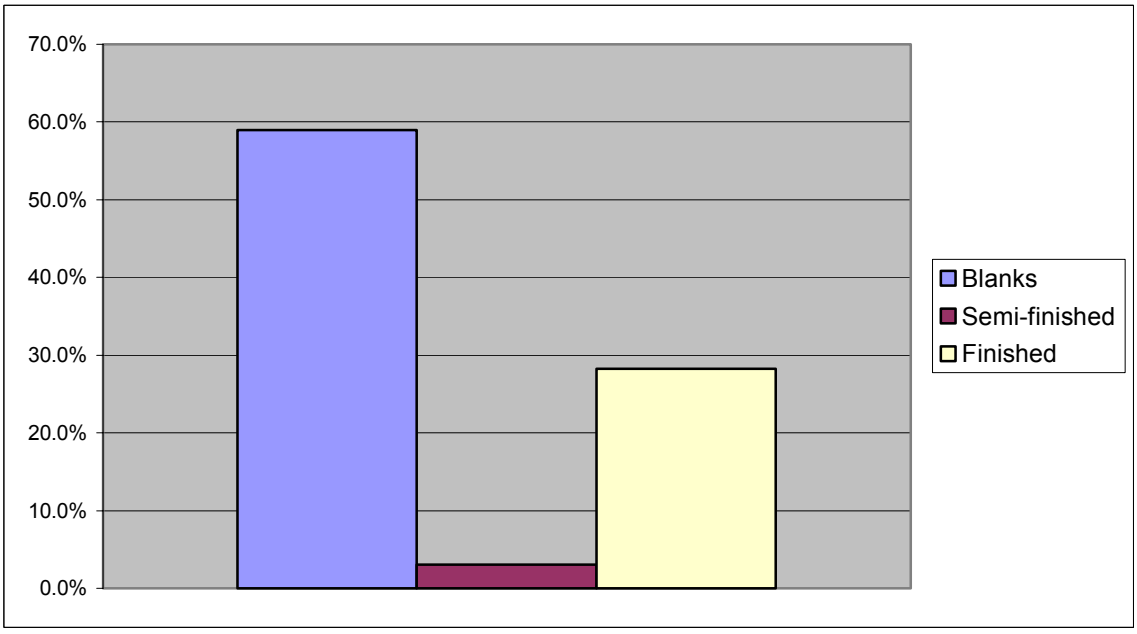

Figure 3.26: Percentages of components purchased by the window and door segment.

With certification becoming an important issue within the forest products industry, a question asked about whether the respondent company was using certified raw materials. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. The participants had three options to

choose from; “No,” “Yes,” and “Don’t know” (Figure 3.27). One respondent told us they were currently using Green Tree as their certifying agency.

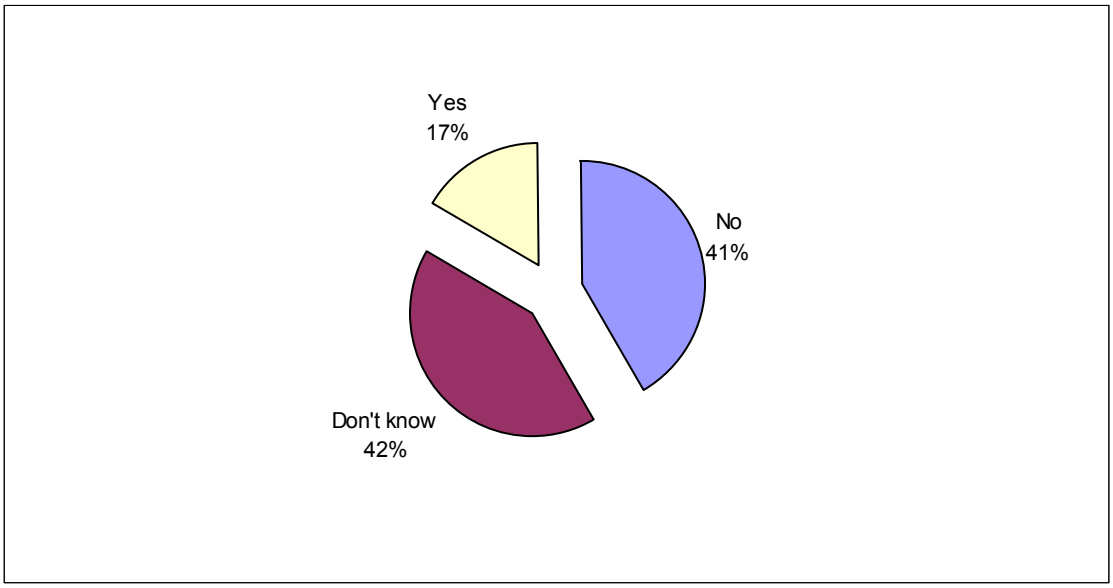

Figure 3.27: Percentage of window and door respondents using certified raw materials.

Outsourcing of needed component parts has become more popular in the secondary wood products industry. Within the windows and doors market segment 34.1% of components were being outsourced. The rest of the component needs are still being produced in-house.

Participants of the survey were asked to rate the importance of many material attributes they demand in the components/component supplier’s product. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). Moisture content (MC) is the most desired attribute in this market segment. Color was rated the lowest attribute, which was not expected, because most products produced by this market segment are used in visual applications (Table 3.37).

Table 3.37: Mean rankings of important material attributes desired from the wood component supplier's product by the window and door segment.

Attributes	Mean
Moisture Content (MC)	6.2
Straightness	6.1
Machinability	5.9
Finishability	5.9
Wane-free	5.9
Lack of knots	5.8
Consistency of MC	5.8
Order lead-time	5.8
Proper dimensions	5.7
Blue/mineral stain-free	5.5
Mechanical properties	5.1
Color	5.1

Scale (1 = not important, 7 = very important)

Respondents were asked a second rating question on service attributes that were based on the same seven-point scale. On average the windows and doors manufacturers prefer good service and a consistent supply to having components at a lower price (Table 3.38).

Table 3.38: Mean rankings of important service attributes of the wood components purchased in the windows and doors market segment.

Attributes	Mean
Consistent supply	6.4
On-time delivery	6.2
Service	6.0
Price stability	5.5
Low price	5.3

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the windows and doors segment. Over one-half of the respondents answered that their company was using some type of E-business. Web sites accounted for most of these responses.

Participants were then asked to please inform us of any new equipment or process which they may have installed at their facility within the past five years. Having CNC equipment was response that was indicated the most. This segment also indicated new types of painting and finishing equipment as well. Processing technology has come mainly in the form of inventory management. Many of the respondents stated that they have currently installed bar coding systems to better handle their products. Computer Aided Design (CAD) software was also indicated as a new process for many companies.

Production Scheduling

Production scheduling information was asked to gain a better understanding of how each market segment handles their manufacturing process. Order expediting accounted for 62.9% of all production scheduling in this market segment (Figure 3.28).

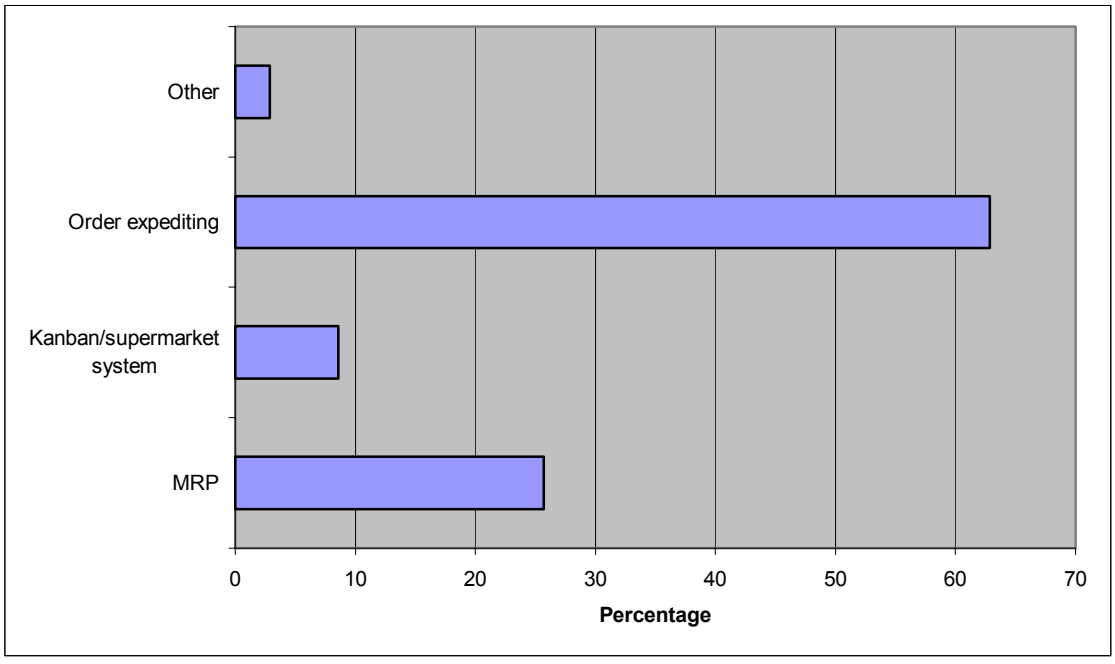

Figure 3.28: Different production scheduling used by window and door companies.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 13.7 days. The

production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 3.9, just below what would be thought of as average. This shows that most windows and doors facilities have a very "choppy" production schedule.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow for the respondent to voice his or her opinions on the use of "non-traditional" species. Many of the responses were similar. In the first question they were asked about potential barriers they may foresee in using these species.

- *Architects specify what we use*
- *Market demand*
- *Weather resistance*
- *Consumer acceptance*

The last question allowed the respondent to share with us anything they felt might be of interest to our study. Many responses were about the same, stating that they will continue to use the same species until consumers or architects ask for something else.

Household Furniture

Profile

The wood household furniture market segment returned 56 completed questionnaires. This resulted in a response rate of 18.6%. The regional distribution of the respondents within this segment is shown in Figure 3.29.

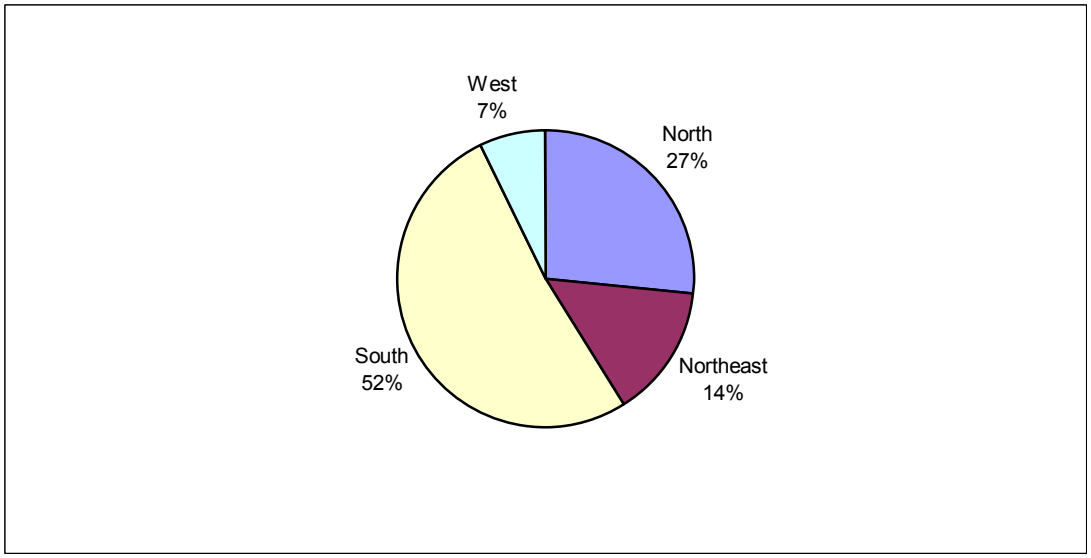

Figure 3.29: Household furniture manufacturer respondents by region.

Household furniture manufacturers were asked if they were a part of a multiple facility company or a single production facility. Thirty-four percent of the respondents were part of companies that had multiple facilities. The one trade association that respondents were mainly a part of was the American Furniture Manufacturers Association (AFMA). Approximately one-half of the respondent companies were participants in this segment trade association.

Most household furniture companies employed less than 50 people at their facilities (Figure 3.30). Table 3.39 shows the study's sales data. Forty-one percent of manufacturers in this segment had sales between $1 million and $5 million.

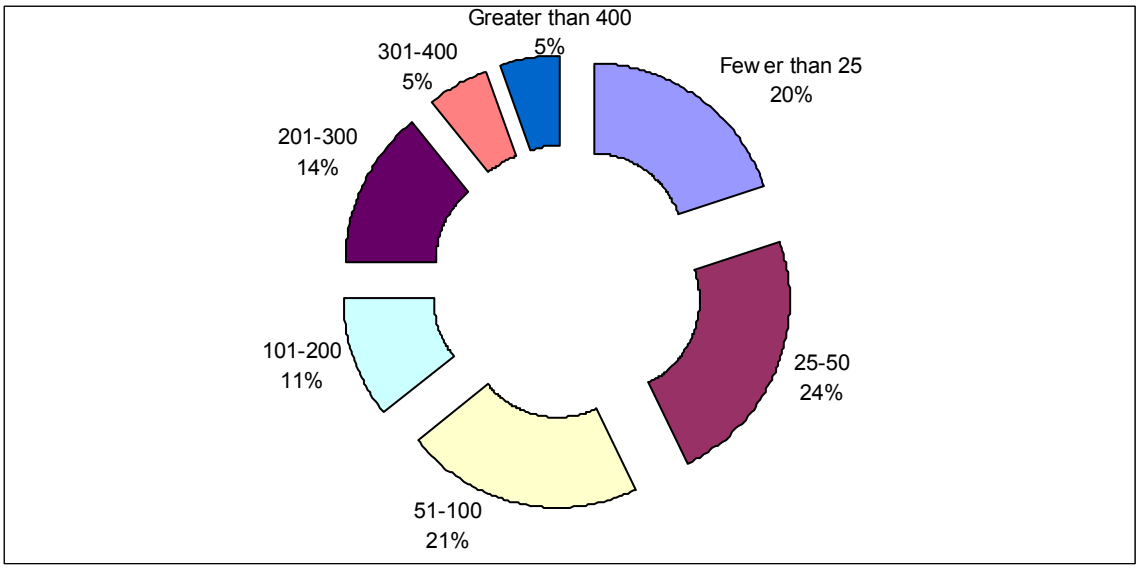

Figure 3.30: Employment per facility within the household furniture market segment.

Table 3.39: Total gross sales for respondent household furniture companies.

	# of respondents	% of respondents
Less than $1,000,000	2	3.6
$1,000,001 - $5,000,000	23	41.1
$5,000,001 - $15,000,000	12	21.4
$15,000,001 - $25,000,000	2	3.6
$25,000,001 - $50,000,000	6	10.7
Greater than $50,000,000	11	19.6

Many of the respondent companies also produced products besides household furniture (Table 3.40). Approximately 18% of household furniture manufactures are also produced office furniture.

Table 3.40: Percentage of household furniture companies that also produce other products.

Dimension and Components	Flooring	Millwork	Cabinets	Windows and Doors	Office Furniture	Other
8.9%	0.0%	3.6%	10.7%	1.8%	17.9%	1.8%

Raw Material Use

The household furniture market segment's average wood raw material cost was calculated to be 34.8% of their total cost associated with doing business. The average

annual lumber input volume at each production facility was calculated to be 1.9 million board feet. The lumber input was also calculated for both hardwood and softwood. Hardwood lumber is the main solid raw material used (1.7 million board feet). Softwood lumber accounted for the other 200,000 board feet. The grades of the lumber that were being used were recorded (Table 3.41).

Table 3.41: Average use of the different grades of hardwood and softwood lumber by the household furniture market segment.

Hardwood Grade	% Used	Softwood Grade	% Used
FAS	8.7	Select	29.4
Selects	3.5	#1	25.4
No. 1 Common	60.9	#2	18.1
No. 2 Common	23.3	#3	5.1
#3A	2.7	Utility	21.9
#3B	0.9	Appearance	0.0

Information was gathered on what species of wood are being used within each market segment. The type of species being currently used will aid in determining what "non-traditional" species may be substituted. Respondents were asked to list the percentage of each species they use in their products. There were 19 species listed along with an "Other" category, which allowed for the respondent to add any species, which we may have left off the list. Table 3.42 shows the average board footage use of each species. White oak is the most commonly used species with 18.5% of the species mix. Red maple and yellow poplar are also popular species used in the furniture market segment. "Traditional" species composed 79.9%. "Traditional" species included Red oak, white oak, cherry, ash, soft maple, hybrid poplar, and yellow poplar. Poplar is a species that is considered to be "non-traditional" to most secondary industries, but the household furniture market segment has found a use for the species. Other segments may

benefit by looking at how poplar has become a popular species in this segment. Many of the species that are currently being used in this segment that are not part of this list were reported to be tropical woods, such as teak and mahogany.

Table 3.42: Average percentage and volume of species use among household furniture manufacturers.

Species	% Used	Board Feet in Thousands
Red Oak	6.0	83.6
White Oak	18.5	256.8
Hard Maple	4.5	61.8
Cherry	7.1	98.6
White Pine	1.8	24.2
Ponderosa Pine	0.3	4.2
Hickory	0.0	0.1
Ash	9.2	127.2
Soft Maple	15.8	219.1
Hybrid Poplar	6.4	88.4
Southern Yellow Pine	1.3	18.4
Radiata Pine	2.2	31.1
Douglas Fir	0.3	4.2
Yellow Birch	0.9	12.7
Yellow Poplar	16.9	234.6
Aspen	0.0	0.2
White Birch	0.0	0.3
Gum	0.3	4.1
Alder	3.6	50.2
Other	4.7	65.3

When asked about the major factors considered when a household furniture company decides on what species of wood to use, customer demand was reported by 86.4% of respondents. This segment also found cost to be a major factor. Over one-half of the respondents checked cost as one of their major factors when deciding on which species to purchase.

Respondents were asked to estimate their usage of material other than solid lumber. Within this segment a large amount of blanks were being used (Figure 3.31).

This market segment used more components than the other secondary industries. Respondents were asked to inform us of which types of components they were purchasing. Blanks are considered to be unfinished components, which are not ready for assembly. The other two categories of components were finished and semi-finished. These two options are only differentiated by their degree of value that has been added to the component manufacturer (Figure 3.32).

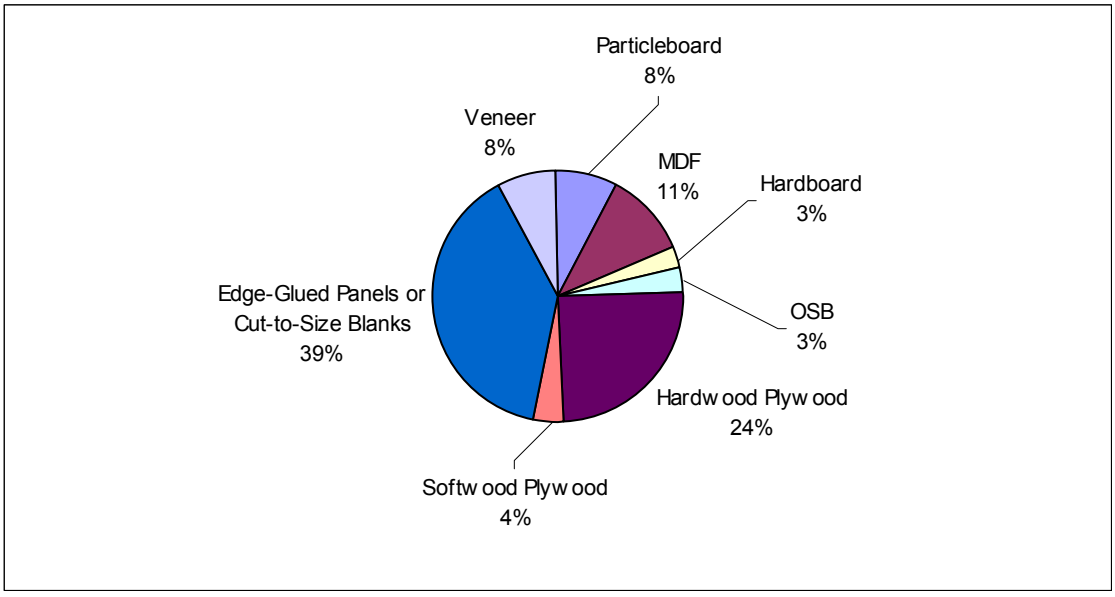

Figure 3.31: Material use, excluding lumber, in the household furniture market segment.

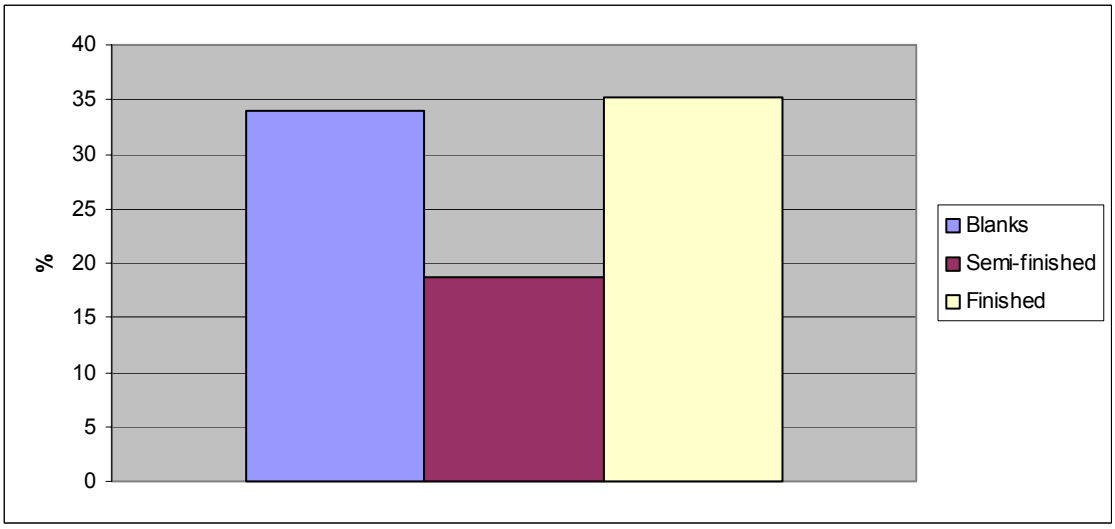

Figure 3.32: Percentages of components purchased by household furniture companies.

With certification becoming an important issue within the forest products industry, respondents were asked about whether the respondent company was using certified raw materials. Certification from a third party agency assures that a forestry operation meets standards that are set by the certifying agency. Only four respondents answered that they were using certified materials. The participant could choose from two other options as well, which were "No" and "Don't know". Fifty-seven percent and 35.7% of the participants filled out these two options, respectively. For the companies that were using certified products, these agencies and programs were identified: FSC, SFI, and SmartWood.

Outsourcing of component needs has become more popular in the secondary wood products industry. Within the household furniture market segment 22.1% of components were being outsourced. The rest of the wood components that are being used are produced in-house.

Participants of the survey were asked to rate the importance of many material attributes they demand in the components/component supplier's product. This question was based on a Likert type rating scale, (1 = Not Important, 7 = Very Important). The household furniture market segment ranked proper dimensions and moisture content (MC) as the most important attributes they desired from their component suppliers (Table 3.43).

Respondents were asked a second rating question on service attributes that were based on the same seven-point scale (Table 3.44). Three attributes were rated with the same importance: consistent supply, service, and on-time delivery.

Table 3.43: Mean rankings of important material attributes desired in wood component supplier's product by the household furniture market segment.

Attributes	Mean
Proper dimensions	6.2
Moisture Content (MC)	6.1
Consistency of MC	6.0
Straightness	5.8
Color	5.7
Blue/mineral stain-free	5.6
Finishability	5.5
Lack of knots	5.4
Order lead-time	5.4
Machinability	5.3
Wane-free	5.3
Mechanical properties	4.9

Scale (1 = not important, 7 = very important)

Table 3.44: Mean rankings of important attributes of the wood components purchased in the household furniture market segment.

Attributes	Mean
Consistent supply	6.1
Service	6.1
On-time delivery	6.1
Low price	5.6
Price stability	5.5

Scale (1 = not important, 7 = very important)

Processing Technology

Information was collected on the current technology being used in the household furniture market segment. Forty percent of companies said they participate in some type of E-business. The majority of these respondents were using a web site for advertising their company. Participants were asked to inform us of any new equipment or process which they may have installed at their facility within the past five years. Installation of more automated equipment was the most common response. CNC machining equipment was pointed out as new equipment that most respondents had installed. New technology

is a predictor of proactive companies that may be willing to use new species. Processing technology was reported in the form of inventory management systems, which included the use of bar coding and computer software.

Production Scheduling

Production scheduling questions were also asked to gain a better understanding of how each market segment handles their manufacturing process. Material Resource Planning (MRP) was the most common response with 42% of the respondent companies using this type of scheduling (Figure 3.33).

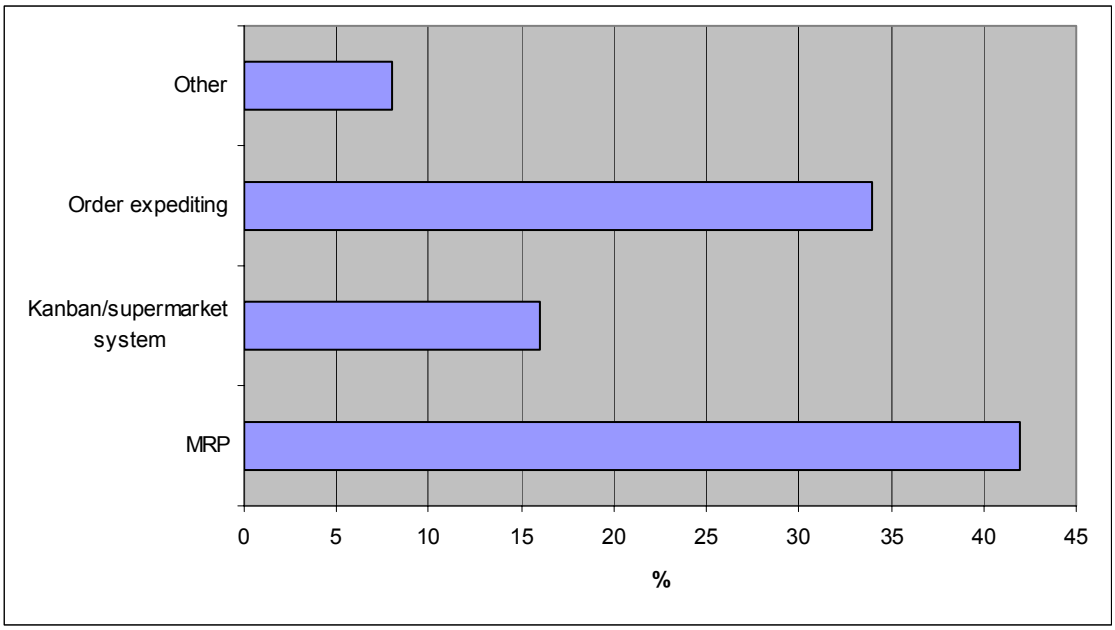

Figure 3.33: Types of production scheduling used household furniture companies.

The average production lead-time (i.e., how long does it take for a product to travel through all processes in your operation) was calculated to be 24.4 days. The production flow within the respondent's company was ranked on a 1-7 scale with (1 = Highly variable/intermittent, 7 = Smooth/continuous). The mean for this particular question was 4.1, just above what would be thought of as average. With this being the

case it can be concluded that the average lead-time would vary even within each production facility.

Comments and Suggestions

Concluding the questionnaire were two open-ended questions that would allow for the respondent to voice his or her opinions on the use of "non-traditional" species. Many of the responses were similar in nature. Respondents were asked about potential barriers they may foresee in using these species. The main responses were:

- *Finishability*
- *Availability*
- *Consumer acceptance*

Respondents were also allowed to inform us of any information that might be useful to this research. One respondent noted that labor is a big issue to his market segment. Other comments stated that Yellow Birch finishes really well and that Sycamore had been introduced at a few plants with success.

Market segment Comparison

Profile

The seven wood products market segments returned a total of 357 completed questionnaires. This gave an overall response rate of 16.8%. The regional distribution of the respondents is shown in Figure 3.34. Regional distribution was included in this study so it could be determined if there were any differences that could be addressed with a marketing effort. The study will recommend regional strategies to target species use within the United States (US).

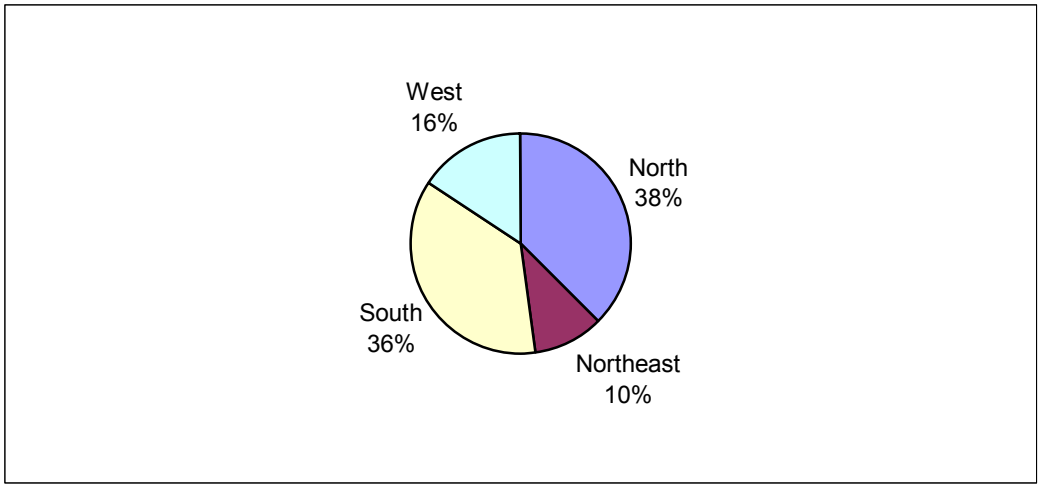

Figure 3.34: Region distribution of the seven wood product market segments.

Component Attributes

Analysis of Variance (ANOVA) was run to find differences among the seven market segments mean ratings of component and component suppliers attributes (Table 3.45). ANOVA was used in place of Multiple Analysis of Variance (MANOVA) due to sample size. Testing was done at the .05 level of significance. Due to sample size non-parametric testing (Kruskall Wallis) was also used to confirm the analysis of variance. Differences that did exist between the ANOVA and non-parametric test are noted in Table 3.45. In the ANOVA consistent supply, proper dimensions, finishability, color, lack of knots, wane-free, and low price were found to have significant differences among the market segments. Significance levels were calculated below the .05 level for proper dimensions, lack of knots, and wane-free. In each of these cases differences were found in more than three market segments. In the flooring and dimension market segments they have low mean ratings for lack of knots because their segment is less sensitive to this defect, whereas the cabinet, millwork, office furniture, and windows and doors segments need their wood components to have less defects, such as knots. Low price and color had significance differences at the .01 level in the household and cabinet segment. Low price

was found to be different between the household furniture segment, which had a mean rating of 5.6, and the cabinet segment, which had a mean of 4.7. This indicates that the cabinet segment is less sensitive to price. Other attributes that displayed significant differences were consistent supply and finishability.

Table 3.45: Mean ratings of component attributes and components supplier attributes according to market segment.

Attribute	Overall Mean	Cabinets (1)	Flooring (2)	Millwork (3)	Office Furniture (4)	Dimension and Components (5)	Windows and Doors (6)	Household Furniture (7)	Significance Level
Consistent supply	6.1	6.3 2	5.6 1,6	6.1	6.1	6.1	6.4 2	6.1	**0.04****
Service	6.0	6.1	5.9	6.1	6.0	--	6.0	6.1	0.97
Moisture Content (MC)	6.0	6.1	5.6	6.3	6.1	5.6	6.2	6.1	0.15
On-time delivery	5.9	6.2 2	5.4 1	5.9	5.9	5.8	6.2	6.1	0.06***
Consistency of MC	5.9	6.0	5.6	6.2	5.9	5.6	5.8	6.0	0.51
Straightness	5.8	5.9	5.5	5.9	5.5	5.5	6.1	5.8	0.18
Proper dimensions	5.7	5.2 7	4.9 5,7	5.7	5.6	6.1 2	5.7	6.2 1,2	**<0.01***
Blue/mineral stain-free	5.6	5.8	5.2	5.6	5.7	5.4	5.5	5.6	0.77
Price stability	5.6	5.5	6.0	5.5	5.5	5.5	5.5	5.5	0.42
Machinability	5.5	5.3	5.4	5.5	5.6	5.7	5.9	5.3	0.32
Finishability	5.5	5.7	5.4	5.5	6.1 5	4.8 4	5.9	5.5	**0.03****
Order lead-time	5.5	5.6	5.5	5.5	5.4	5.2	5.8	5.4	0.71
Color	5.5	6.1 2	5.1 1	5.3	5.7	5.5	5.1	5.7	**0.01***
Lack of knots	5.3	5.6 2,5	3.9 1,3,4,6,7	5.9 2,5	5.7 2,5	4.5 1,3,4,6	5.8 2,5	5.4 2	**<0.01***
Wane-free	5.2	5.4 2	4.3 1,3,6	5.4 2	5.4	4.7 6	5.9 2,5	5.3	**<0.01***
Low price	5.2	4.7 7	5.5	5.0	5.2	5.0	5.3	5.6 1	**0.01***
Mechanical properties	5.0	4.9	5.1	5.2	5.0	4.7	5.1	4.9	0.85

1,2,3,4,5,6,7 Represent significant differences between market segments.
*** Represents ANOVA significance, at least one difference among groups.**
**** Represents difference between ANOVA significance level and Non-Parametric significance level. ANOVA showed significance.**
***** Represents difference between ANOVA significance level and Non-Parametric significance level. Non-Parametric showed significance.**

ANOVA was performed to see if any differences among the four different regions of the US were present. Significance was found below the .05 level for on-time delivery. The difference was found between the North and Northeast regions. The North had a mean rating of 5.8 and Northeast had a rating of 6.4 (Table 3.46). It can be concluded that the Northeast states value on-time delivery more than the Northern states.

It can be concluded that the segments have similar requirements for the attributes across the regions of the US.

Table 3.46: Mean ratings of component attributes and components supplier attributes according to region of the US.

Attribute	Overall Mean	North (1)	Northeast (2)	South (3)	West (4)	Significance Level
Consistent Supply	6.1	6.0	6.2	6.2	6.2	0.52
Moisture Content (MC)	6.0	6.0	6.1	6.0	6.0	0.94
Service	6.0	6.0 2	6.2 1	6.1	6.1	0.83
On-time delivery	5.9	5.8	6.4	6.0	6.0	**0.03 ****
Consistency of MC	5.9	5.9	5.9	6.0	5.9	0.84
Straightness	5.8	5.7	5.5	5.8	5.9	0.62
Proper dimensions	5.7	5.9	5.5	5.6	5.4	0.23
Blue/mineral stain-free	5.6	5.5	5.5	5.7	5.7	0.87
Price Stability	5.6	5.5	5.4	5.6	5.7	0.55
Order lead time	5.5	5.4	5.4	5.6	5.6	0.66
Machinability	5.5	5.3	5.4	5.7	5.6	0.25
Finishability	5.5	5.3	5.4	5.9	5.8	0.09
Color	5.5	5.5	5.3	5.6	5.6	0.67
Lack of knots	5.3	5.3	5.3	5.2	5.6	0.61
Wane-free	5.2	5.2	5.1	5.3	5.4	0.77
Low price	5.2	5.2	4.9	5.2	5.1	0.82
Mechanical Properties	5.0	4.9	5.2	5.1	4.7	0.35

1,2,3,4 **Represent significant differences between regions.**
*** Represents difference between ANOVA significance level and Non-Parametric significance level. ANOVA showed significance.**

This research focused on the secondary wood products industry. This included wood component manufacturers and wood component consuming market segments (cabinets, flooring, millwork, office furniture, windows and doors, and household furniture). This research did not investigate perceptions felt on "non-traditional" species by sawmills or the end consumers. Figure 3.35 displays the flow of wood material through the forest products industry. The figure summarizes which attributes are most desired by the wood component consuming market segments.

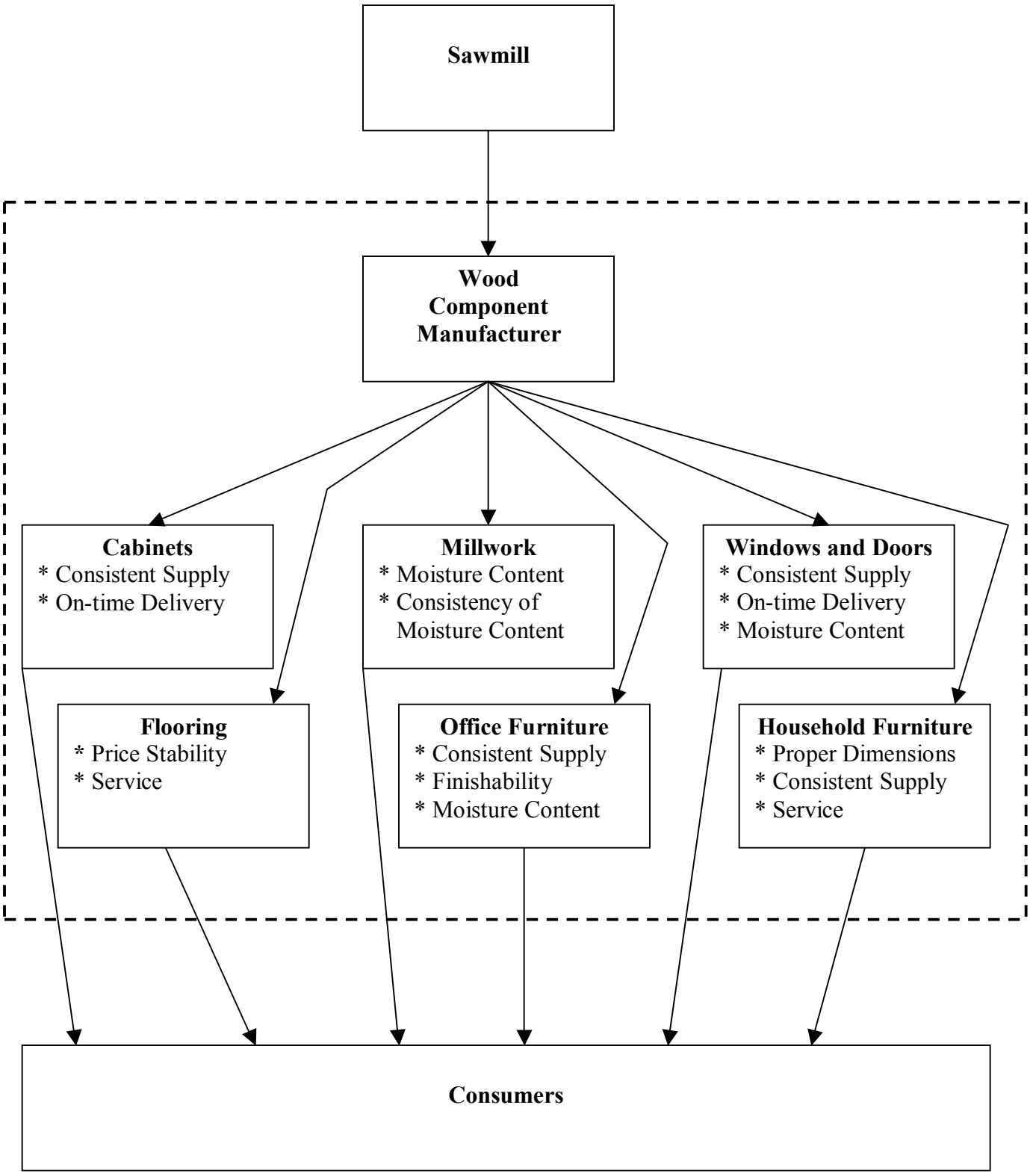

Figure 3.35: Flow chart of the forest products industry highlighting the attributes that the six wood component consuming market segments desire the most.

CONCLUSIONS

The use of "non-traditional" species within the seven secondary market segments surveyed was very limited. Many of these segments are driven by fashion trends that limit the variety of woods they can use. Oak, both red and white, were the two most used species in the secondary industry. Most respondents commented that they use oak because of its desirable look and durability. Of the "non-traditional" species both birch and radiata pine were used in many segments. Some respondents in the millwork and furniture segments commented that the use of these species has substituted nicely for their "traditional" species.

Respondents to the survey were still producing most of their components in-house. Much has been published about how outsourcing is the new trend, but our research indicated that most companies still manufacture most of their needs on-site. Overall component usage among these segments was also low. Household furniture and flooring were the two segments that reported using the most components.

Major factors that the secondary industry considers when purchasing wood components included customer demand, cost, and supply. These factors were rated high in that order in the market segments. This displays that the secondary industries are more reactive to what designers and consumers want than they are to price. Most of the market segments noted that they would not be making any change in their species choice unless the end user specifies them.

Technology in most of the market segments has vastly improved over the past five years. Nearly all of the respondents reported that they have updated their facility in that time. Most of the improvements were CNC machines that allowed for faster and

more precise cutting of their product. Another form of technology that may aid in the use of "non-traditional" species are finishing lines. Respondents noted that if they could match the color and the finish of "non-traditional" species to those that they currently use then they would be able to use them. These new finishing systems allow for companies to sand, paint, stain, and dry many of their products in a faster and better way.

The secondary market segments did differ among which attributes were the most important to them. Low price did not have a big effect on cabinet manufacturers, but was very important to household furniture companies. Wane was an issue for cabinets, millwork, and windows and doors, but had little importance to the flooring manufacturer. Knots were rated a problem for all of the segments except flooring. This agrees with the fact that flooring manufacturers buy lower grade lumber. There was also a difference between flooring and cabinets on the color attribute. Cabinet manufacturers need their product to have a consistent color. Having proper dimensions of the components purchased also differed among the segments. The household furniture respondents rated this attribute higher than any of the other market segments. The last attribute that had any significant differences between the market segments was consistent supply. This attribute was rated higher by cabinets and windows and doors, but was not high for the flooring manufacturer.

The wood component and dimension market segment would benefit from the use of "non-traditional" species. It offers an excellent opportunity for the segment to produce these products at a lower price than using "traditional" species. Many respondents to the survey stated that they would like to use the species, but that none of the secondary industries are willing to purchase the components. The species that the market segment

is currently using the most is red oak, which accounts for approximately 32% of production from this species. The market segment's current trend is to obtain the highest possible yield from lower grades of lumber. If more affordable "non-traditional" species could be used then the segment could use higher grades, making it possible to produce more components at a lower cost.

The results show that most of the components being made are sold to the cabinet and household furniture segment. It is important to know your customer. Based on the ratings of the attributes the component segment has done a good job at this. They do not differ in any category from their two main customers.

The results of the study indicate that different strategies will have to be used by the wood component market segment. Cabinet manufacturers are very cautious to the use of any new species. Respondents stated that they would not be changing their product unless the designer, architect, or customer asked for it. If the use of "non-traditional" species is going to work in this market segment the wood component manufacturers are going to have to show consumers of cabinets that "non-traditional" species can be used as an affordable substitute. Cabinet manufacturers are also going to need more information on the finishing properties of these species. This market segment is not as interested in the mechanical properties as they are the looks of their product.

The flooring market segment already uses less expensive low-grade lumber; so alternative species will not save them much money. This market segment is more focused on durability and finishability. Respondents stated that they choose certain species because of the way they hold up under high amounts of wear. Data on which

"non-traditional" species have high durability will need to be gathered and presented to this market segment.

The millwork market segment is also very much driven by fashion. Much of their products are produced to match other market segments' products, such as furniture and cabinets. This market segment was most concerned with moisture content. The products that they produce are placed in environments where it will be very dry. They cannot use components that have high and/or varied moisture contents because their product will shrink. This can cause splits and cracks that are not acceptable. The market segment will have to convey to this segment that these species can be properly dried and are dimensionally stable. Data on the characteristics of the species will need to be presented.

The office furniture and household furniture market segments can be treated in the same manner. These two segments did not differ in their ratings on any of the component attributes. Yellow poplar is a species that is being used more and more in this market segment. Yellow poplar has been considered a "non-traditional" species by most segments until recently. The market segments are not as sensitive to mechanical properties as they are to finishablity. This again is a segment that is driven by fashion and what is currently "in-style." If it can be shown that a species can be used that finishes as well as the "traditional" ones then these market segments will be willing to accept them.

The wood windows and doors market segment's species mix consists mainly of hard maple. The respondents within this market segment stated that they desire a product that will finish well and will be able to withstand nature's elements. Many of the products that are made by this market segment are exposed to the outdoors. Providing

data on which species will be best suited for exposure to weather and sunlight will aid in getting this segment to use “non-traditional” species

Within all of the secondary industries respondents stated that they would be willing to try new species if there was a market for them. Data on these species will need to be collected and reported to the secondary industry. The wood component manufacturers will also need to distribute this information to designers, architects, and consumers as well. Most of the respondents to this survey are prepared to use other species. Getting consumers to accept the “non-traditional” species will be the way that these species begin to get used.

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Chapter 4

Abstract

The secondary wood products industry uses a wide variety of wood species. The most predominately used species is red oak. Red oak was the most used species in each of the seven market segments that were surveyed; cabinets, flooring, millwork, office furniture, dimension and components, windows and doors, and household furniture. Red oak is considered a "traditional" species within each of these market segments. Each market segment also had other "traditional" species. For this study "non-traditional" species and "non-traditional" species users were identified for each individual market segment and the overall secondary industry. A "non-traditional" species was defined as any species that made up less than 5% of the species mix in each individual market segment. This allowed for "non-traditional" species to be identified within each market segment that was surveyed. The 5% cut-off was also used to determine what respondent companies would be considered a "non-traditional" species user. A respondent company whose species mix was made up of 95% or more of their market segments particular "traditional" species would be placed into the group of "traditional" users. The companies that used more than 5% of "non-traditional" species would be placed into the other group, which were "non-traditional" species users. Statistical comparisons were then made between the two groups.

Consistent supply was one attribute where the two groups displayed significant differences on their rating of importance. "Non-traditional" species users rated consistent supply higher. Many companies that use "non-traditional" species are concerned with

having a consistent supply of these species that they use as their raw material. For "non-traditional" species to be successful, a consistent supply line must first be established.

Two market segments where the implementation of "non-traditional" species would have the greatest chance for success would be the millwork market segment and the office furniture market segment. The millwork market segment already uses a wide variety of wood species to produce their products and could use more "non-traditional" species with little to no effect on their product quality. The office furniture segment values a lower price more than the other segments, which is an area that "non-traditional" species can compete in.

Introduction

The secondary wood industry uses a wide variety of species in the production of wood products. In 1999, hardwood sawmills in the United States produced 34% red oak, 16% yellow poplar, 15.5% white oak, 8.8% hard maple, 5.9% soft maple, 4.7% black cherry, and the remainder of 15.1% was composed of a wide variety of other species (Bowe et al. 2000). These species are considered to be traditional species, because they have been commonly used in the past in wood manufacturing.

There has been little published about why "non-traditional" species of wood are not used more often in the manufacturing of wood-based component products. Most manufacturers produce a product that has been ordered from their customer, such as furniture, cabinets, millwork, and others. The main barrier to using different species will be to get manufacturers to produce products that use "non-traditional" species. While little has been published on using alternative species within these market segments, a few studies have evaluated the use of low-grade and character-marked lumber. Most of the barriers that exist for these two issues also exist when trying to introduce new species.

Bumgardner et al. (1999) found that companies who had success with manufacturing and selling character-marked hardwood furniture lines experienced a "learning curve." This learning curve involved both manufacturing and marketing considerations. Some of these companies reported that character-marks were eventually dropped from many of the companies' lines of furniture. Companies that did exhibit some success displayed a degree of patience, giving the product a chance to be accepted when met with initial resistance by retailers or consumers. This degree of patience is

what the industry will need if the introduction of new products made with non-traditional species is to be successful. The change to "non-traditional" species will not be an "overnight" success, but instead will gradually be accepted in the marketplace.

There have also been a number of studies done in an attempt to find a market for lower-grade lumber. Many of the barriers that are faced in the use of low-grade lumber also exist when trying to introduce new species into the market. Using high-grade lumber has its advantages, such as the relative ease with which larger pieces of clear material can be obtained (Gatchell, 1987). Many sawmills would not want to waste their time and energy attempting to use lower-grades of logs and lumber to produce an inferior product. In order for a sawmill to obtain the same yield, which higher-grades of lumber offer, from the lower-grades of lumber an increased machine time is required due to decreasing yield with decreasing lumber grade (Gatchell et al. 1999). This desire of sawmills to cut high-grade lumber can be viewed as an advantage for introducing non-traditional species. Since log quality of traditional species has decreased this can be an opening for companies to use other species and utilize the highest quality logs from the non-traditional species.

Many companies within the secondary industry are currently using alternative or "non-traditional" species. Many companies have found uses for theses species and have found ways to effectively produce and market products made from them. Comparisons between companies that are using "non-traditional" species and those companies that do not use these species would aid in determining what characteristics each group desires in their wood raw material.

Objective

The goal of this study was to identify the differences between companies that use "non-traditional" species and those companies that do not.

Methodology

A mail survey was used to collect primary data. A mail survey was chosen because of the large size of the sample population and the questionnaire length. The research population of interest included manufacturers of wood components and wood component consuming market segments. Seven market segment specific questionnaires were developed to gather information for the fulfillment of the study objectives. Members of the Virginia Polytechnic Institute and State University faculty and employees of the sponsor organization (Forintek, Canada) reviewed the questionnaire. The preliminary questionnaire was faxed to at least three companies within each of the seven market segments for their review. When at least one questionnaire from each of the segments was returned, final adjustments were made and the revised questionnaires were mailed in January 2003.

The sample frame consisted of seven sectors of the secondary wood products industry including; cabinets, flooring, millwork, office furniture, dimension and components, windows and doors, and household furniture. The sample frame was composed using the American Business Disc 2002 (Info USA, 2002). Companies were eliminated that had less than 20 employees. It was assumed that larger companies (i.e., companies with more than 20 employees) would be more likely to adopt the use of new species.

"Non-traditional" species and "non-traditional" species users were identified for each individual market segment and the overall secondary industry. A "non-traditional" species was defined as any species that made up less than 5% of the species mix in each individual market segment. This allowed for "non-traditional" species to be identified within each market segment that was surveyed. The 5% cut-off was also used to determine what respondent companies would be considered a "non-traditional" species user. A respondent company whose species mix was made up of 95% or more of their market segment's particular "traditional" species would be placed into the group of "traditional" users. The companies that used more that 5% of "non-traditional" species would be placed into the other group, which were "non-traditional" species users. Due to sample size non-parametric (Kruskall Wallis) testing was run to find differences among the "non-traditional" and "traditional" mean rating of component and component supplier attributes. Testing was done at the .05 level of significance. Analysis of Variance (ANOVA) was used to confirm the results of the non-parametric tests. ANOVA testing was used as the primary analytical tool in the analysis on the overall secondary industry because of the large sample size. Differences that did exist between the ANOVA and non-parametric test are noted in the results.

Non-response Bias

This study used a sample frame consisting of cabinet, flooring, millwork, office furniture, dimension and component, windows and doors, and household furniture manufacturers in the US. Not all of the manufacturers that were sent a questionnaire participated in the survey. Companies that did not return the questionnaire were contacted to check for non-response bias. Five companies from each market segment

segment were contacted by phone and asked a few of the survey questions. This method for testing for non-response bias was adopted from Dan Cumbo's thesis research (Cumbo, 1999).

Questions where means could be calculated were preferred for comparison. The question that was chosen dealt with component and component supplier attributes; this question was based on a 1 to 7 scale (1= Not Important, 7 = Very Important). From this question three attributes were chosen for the reason of brevity. These attributes included *color*, *moisture content*, and *order lead-time*. The average responses from both the respondent group and the non-respondent group were compared by the use of an independent t-test. The results of the t-test are displayed in Table 4.1.

Table 4.1: Non-response bias t-test results.

Attribute	Group	Mean	Std. Deviation	Significance
Color	Respondents	4.8	2.5	<0.001
	Non-respondents	5.5	1.5	
Moisture Content (MC)	Respondents	5.9	1.6	0.393
	Non-respondents	6.0	1.5	
Order lead-time	Respondents	5.9	1.2	0.416
	Non-respondents	5.5	1.4	

The t-test displayed that there is some difference between respondents and non-respondents on their importance of the attribute of color. A significance level of <0.001 is below the 95% testing level confidence. This indicates that respondents may feel that color is less of an importance than non-respondents. There is a possibility that the error exists because of the way the information was gathered, phone call vs. mail questionnaire. Within this group there is also a high degree of deviation between the respondents. This deviation may be the result of component products being used in different applications across the different segments.

Questions were also asked about whether the non-respondents were members of trade associations and how many full-time employees were at their production facility. No significant difference was found between the respondents and the non-respondents for these two questions.

Another way to test for non-response bias is to compare early respondents to late respondents (Armstrong and Overton, 1977). It is thought that late responses are a valid representation of non-responses. T-tests were again used to analyze the independent means of the attributes *color*, *moisture content*, and *order lead-time*. The test was performed on the first thirty responses and the last thirty responses. There was no significant difference found in any of these attributes. Based on the results of the non-response tests, non-response bias could be removed as a limitation to this study.

Results

Survey data was entered into the SPSS (SPSS, 2003) statistical software package for analysis. A total of 763 questionnaires were returned. Of those, 357 were deemed usable, resulting in an overall response rate of 14.3%. There were 238 undeliverable questionnaires and 168 returned questionnaires by companies that are not participating in operations this study was targeting. After these questionnaires were eliminated, the adjusted response rate was 16.8%. As the questionnaires were returned they were separated into the seven separate segments. The numbers of responses in each of the market segments are as follows: cabinets (72), flooring (39), millwork (79), office furniture (37), dimension and components (38), windows and doors (36), and household furniture (56). These responses resulted in response rates of 16.9% for cabinets, 20.7% for flooring, 15.7% for millwork, 16.2% for office furniture, 11.2% for dimension and

components, 7.6% for windows and doors, and 16.2% household furniture. After removing the non-usable questionnaires the adjusted response rates are 18.1% for cabinets, 25.9% for flooring, 17.8% for millwork, 18.4% for office furniture, 14.5% for dimension and components, 9.2% for windows and doors, and 18.6% for household furniture.

Secondary Industry

Red oak, white oak, hard maple, cherry, ponderosa pine, and yellow poplar were determined to be "traditional" species within the secondary industry. Soft maple and radiata pine were two "non-traditional" species that were being used in this industry. There were 80 respondent companies that had a species mix that contained 95% or greater of the above species. There were 190 respondent companies that were considered to be "non-traditional" species users. This sample size allowed for the use of ANOVA testing as the primary analytical tool. Within the secondary industry "traditional" species companies were using on average two and a half times the amount of lumber as the companies that are categorized as "non-traditional" companies. "Traditional" species users were using on average 5 million board feet a year per respondent company, whereas "non-traditional" users were consuming 2.1 million board feet a year. "Non-traditional" species users valued consistent supply, moisture content (MC), and blue/mineral stain-free wood more than the "traditional" users (Table 4.2). Many companies that use "non-traditional" species report that supply chains can be a major issue when it comes to receiving a consistent supply of raw material. This would be one factor why "non-traditional" species users rated consistent supply higher.

Other attributes that were above the confidence interval, but could also be viewed as possible differences between the groups were on-time delivery, straightness, and proper dimensions. On-time delivery could again be attributed to problems that may exist with continually receiving a supply of the "non-traditional" species.

Table 4.2: Secondary industry comparison between "traditional" and "non-traditional" species using companies.

Attribute	Material Type	N	Mean	Significance Level
Consistent supply	Traditional	79	5.9	**0.04**
	Non-traditional	190	6.2	
Service	Traditional	63	6.0	1.00
	Non-traditional	155	6.0	
Moisture Content (MC)	Traditional	80	5.6	**<0.01**
	Non-traditional	184	6.2	
On-time delivery	Traditional	80	5.7	0.06
	Non-traditional	188	6.0	
Consistency of MC	Traditional	78	5.6	0.20
	Non-traditional	180	6.1	
Straightness	Traditional	80	5.9	0.10
	Non-traditional	181	5.7	
Proper dimensions	Traditional	76	5.9	0.07
	Non-traditional	180	5.7	
Blue/mineral stain-free	Traditional	73	5.1	**0.02**
	Non-traditional	180	5.6	
Price stability	Traditional	80	5.6	0.28
	Non-traditional	188	5.5	
Machinability	Traditional	78	5.4	0.79
	Non-traditional	179	5.5	
Finishability	Traditional	74	5.5	0.70
	Non-traditional	176	5.5	
Order lead-time	Traditional	77	5.5	0.36
	Non-traditional	181	5.4	
Color	Traditional	77	5.2	0.16
	Non-traditional	182	5.5	
Lack of knots	Traditional	74	5.2	0.38
	Non-traditional	178	5.4	
Wane-free	Traditional	73	5.2	0.95
	Non-traditional	170	5.2	
Low price	Traditional	80	5.2	0.61
	Non-traditional	188	5.1	
Mechanical properties	Traditional	75	5.2	0.29
	Non-traditional	173	5.0	

Scale (1 = not important, 7 = very important)

Cabinets

Red oak, hard maple, cherry, and soft maple were determined to be "traditional" species within the cabinet market segment. Hickory is a species that is considered to be "non-traditional," however this species is rising in popularity among cabinet consumers. This species has displayed that alternative species can be used in the cabinet market segment with success. White birch has also displayed some use in this segment. This specie can be used in non-visual applications, such as cabinet drawers and backs. There were seven respondent companies that had a species mix that contained 95% or greater of the above species. Forty-seven respondent companies were considered to be "non-traditional" species users. "Traditional" companies used an average of 8 million board feet a year per respondent company, whereas the "non-traditional" companies used 1 million board feet a year on average. "Traditional" species users valued a consistent supply of raw material more than "non-traditional" users (Table 4.3). The cabinet segment differs from the other market segments on this attribute. Most users of "traditional" species are not as concerned with consistent supply because their supply lines are already in place and have been used for years. The cabinet segment respondents displayed that "traditional" species users are very concerned with having their raw material consistently supplied.

Table 4.3: Cabinet market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Material Type	N	Mean	Significance Level
Machinability	Traditional	6	4.8	0.49
	Non-traditional	40	5.8	
Finishability	Traditional	6	6.0	0.95
	Non-traditional	40	5.7	
Straightness	Traditional	6	6.3	0.21
	Non-traditional	41	5.8	
Wane-free	Traditional	6	5.3	0.66
	Non-traditional	41	5.4	
Color	Traditional	6	6.0	0.87
	Non-traditional	43	6.1	
Proper dimensions	Traditional	6	5.8	0.36
	Non-traditional	42	5.2	
Blue/mineral stain-free	Traditional	6	6.3	0.23
	Non-traditional	41	5.7	
Lack of knots	Traditional	6	5.5	0.91
	Non-traditional	40	5.5	
Moisture Content (MC)	Traditional	6	6.2	0.65
	Non-traditional	42	6.0	
Consistency of MC	Traditional	6	6.2	0.55
	Non-traditional	41	6.0	
Mechanical properties	Traditional	6	5.2	0.72
	Non-traditional	39	4.9	
Order lead-time	Traditional	6	6.2	0.16
	Non-traditional	42	5.4	
Low price	Traditional	7	4.9	0.51
	Non-traditional	45	4.5	
Price stability	Traditional	7	5.9	0.28
	Non-traditional	45	5.3	
On-time delivery	Traditional	7	6.7	0.11
	Non-traditional	45	6.1	
Consistent supply	Traditional	7	6.9	**0.03**
	Non-traditional	45	6.2	
Service	Traditional	7	6.6	0.12
	Non-traditional	47	6.0	

Scale (1 = not important, 7 = very important)

Flooring

Red oak, white oak, and hard maple were determined to be "traditional" species within the flooring market segment. These three species comprised more than 95% of the flooring market segments species mix. Two of the "non-traditional" species that were being used were hickory and yellow birch. Hickory has displayed the characteristics of a

durable and aesthetically pleasing species. Hickory's popularity will continue to grow as more consumers are introduced to the product. There were 12 respondent companies that were classified as "traditional" users and 17 respondent companies were considered to be "non-traditional" species users. The "traditional" users in this market segment were consuming 19.7 million board feet a year on average per respondent company and "non-traditional" users were consuming 3.3 million board feet a year. In this market segment there were no significant differences between the two groups on any of the attributes.

Some notable attributes that bordered on significance were wane-free, color, and service (Table 4.4). "Non-traditional" users rated wane-free higher than "traditional" users. Users of "non-traditional" species need to find better and higher grades of lumber if they want their product to compete with "traditional" species. For "non-traditional" species to compete the lumber must be of higher quality which means companies that use these species desire aesthetic qualities more than "traditional" species users. As a group the "non-traditional" users rated the component product attributes higher than the "traditional" users. This indicates that "non-traditional" users are more concerned with the quality of species and product they are purchasing and using in the manufacture of their product.

Table 4.4: Flooring market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Material Type	N	Mean	Significance Level
Machinability	Traditional	12	5.8	0.24
	Non-traditional	15	5.1	
Finishability	Traditional	11	5.9	0.29
	Non-traditional	15	5.3	
Straightness	Traditional	12	5.0	0.27
	Non-traditional	16	5.6	
Wane-free	Traditional	12	3.8	0.08
	Non-traditional	14	4.9	
Color	Traditional	12	4.4	0.08
	Non-traditional	16	5.5	
Proper dimensions	Traditional	12	5.3	0.67
	Non-traditional	15	4.9	
Blue/mineral stain-free	Traditional	12	4.6	0.13
	Non-traditional	16	5.5	
Lack of knots	Traditional	11	3.3	0.11
	Non-traditional	16	4.5	
Moisture Content (MC)	Traditional	12	5.5	0.78
	Non-traditional	17	6.1	
Consistency of MC	Traditional	12	5.9	0.88
	Non-traditional	17	6.1	
Mechanical properties	Traditional	12	5.9	0.22
	Non-traditional	14	5.0	
Order lead-time	Traditional	12	4.8	0.20
	Non-traditional	15	5.9	
Low price	Traditional	11	5.1	0.59
	Non-traditional	17	5.6	
Price stability	Traditional	11	6.2	0.80
	Non-traditional	17	6.0	
On-time delivery	Traditional	11	5.4	1.0
	Non-traditional	16	5.4	
Consistent supply	Traditional	11	5.5	0.66
	Non-traditional	17	5.8	
Service	Traditional	6	6.7	0.08
	Non-traditional	10	5.7	

Scale (1 = not important, 7 = very important)

Millwork

Red oak, ponderosa pine, radiata pine, and yellow poplar were determined to be "traditional" species within the millwork market segment. The millwork segment uses a wide range of species, many of which would be on the 5% cut-off border between being considered "traditional" or a "non-traditional" species. Some "non-traditional" species that were being used by the millwork segment were Douglas fir, hard maple, soft maple, cherry, and white pine. This market segment displayed that a wide variety of species could be used in their consumer markets. There were 20 respondent companies that were classified as "traditional" users and 39 respondent companies were considered to be "non-traditional" species users. The average board footage use for a "traditional" manufacturer was 5.3 million board feet per year and a "non-traditional manufacturer was 2 million.

There were three attributes that displayed a significant difference. On-time delivery, consistent supply, and service attributes were all rated significantly higher by "non-traditional" species users (Table 4.5). These attributes were all similar in nature, such as they all dealt with the supply of the raw material. This shows that "non-traditional" species users in the millwork market segment value having a better supply and supplier more than "traditional" users.

Table 4.5: Millwork market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Material Type	N	Mean	Significance Level
Machinability	Traditional	20	5.4	0.76
	Non-traditional	36	5.5	
Finishability	Traditional	18	4.9	0.09
	Non-traditional	34	5.7	
Straightness	Traditional	20	5.9	0.86
	Non-traditional	36	5.9	
Wane-free	Traditional	16	5.6	0.82
	Non-traditional	34	5.5	
Color	Traditional	18	5.1	0.37
	Non-traditional	36	5.4	
Proper dimensions	Traditional	19	5.8	0.67
	Non-traditional	35	5.6	
Blue/mineral stain-free	Traditional	19	5.7	0.55
	Non-traditional	35	5.5	
Lack of knots	Traditional	18	5.9	0.93
	Non-traditional	36	5.9	
Moisture Content (MC)	Traditional	20	6.0	0.19
	Non-traditional	36	6.4	
Consistency of MC	Traditional	20	6.1	0.91
	Non-traditional	36	6.1	
Mechanical properties	Traditional	19	5.3	0.82
	Non-traditional	35	5.3	
Order lead-time	Traditional	19	5.3	0.48
	Non-traditional	35	5.5	
Low price	Traditional	20	5.1	0.61
	Non-traditional	39	4.9	
Price stability	Traditional	20	5.8	0.08
	Non-traditional	39	5.2	
On-time delivery	Traditional	20	4.9	**<0.01**
	Non-traditional	39	6.3	
Consistent supply	Traditional	20	5.6	**0.03**
	Non-traditional	39	6.3	
Service	Traditional	17	5.2	**<0.01**
	Non-traditional	38	6.3	

Scale (1 = not important, 7 = very important)

Office Furniture

Red oak, hard maple, cherry, and soft maple were determined to be "traditional" species within the office furniture market segment. "Non-traditional" species that were currently being used in the office furniture market segment include alder, yellow poplar, yellow birch, and ash. Ash is one "non-traditional" species that has displayed growth in the segment. There were 11 respondent companies that were classified as "traditional"

users and 18 respondent companies were considered to be “non-traditional” species users, which had a species mix that consisted of more than 5% “non-traditional” species. Companies that were using “non-traditional” species averaged 158 thousand board feet per year and “traditional” users were averaging 360 thousand board feet per company.

The office furniture market segment showed significant differences between “traditional” and “non-traditional” species users in the area of low price (Table 4.6). “Non-traditional” users rated low price to be more important. This indicates that companies that are using “non-traditional” species are attempting to have a lower priced raw material. Many companies that use “non-traditional” products attempt to compete in the market by having a lower price. In order to have a lower priced product the raw material must also be lower in price than the “traditional” wood species. One other noteworthy category was straightness. “Traditional” users rated straightness higher.

Table 4.6: Office furniture market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Material Type	N	Mean	Significance Level
Machinability	Traditional	10	5.4	0.48
	Non-traditional	18	5.6	
Finishability	Traditional	9	6.2	0.34
	Non-traditional	17	5.9	
Straightness	Traditional	10	5.9	0.10
	Non-traditional	18	5.2	
Wane-free	Traditional	9	5.3	0.94
	Non-traditional	18	5.3	
Color	Traditional	11	5.5	0.92
	Non-traditional	17	5.7	
Proper dimensions	Traditional	11	5.3	0.70
	Non-traditional	17	5.8	
Blue/mineral stain-free	Traditional	8	5.4	0.27
	Non-traditional	18	5.8	
Lack of knots	Traditional	9	5.2	0.16
	Non-traditional	18	5.8	
Moisture Content (MC)	Traditional	11	5.7	0.14
	Non-traditional	18	6.3	
Consistency of MC	Traditional	10	5.7	0.48
	Non-traditional	18	6.0	
Mechanical properties	Traditional	10	5.0	0.59
	Non-traditional	16	4.9	
Order lead-time	Traditional	10	5.7	0.30
	Non-traditional	19	5.2	
Low price	Traditional	11	4.6	**0.02**
	Non-traditional	15	5.9	
Price stability	Traditional	11	5.4	0.59
	Non-traditional	17	5.5	
On-time delivery	Traditional	11	6.2	0.31
	Non-traditional	17	5.6	
Consistent supply	Traditional	11	6.0	0.90
	Non-traditional	16	6.1	
Service	Traditional	11	5.8	0.50
	Non-traditional	17	6.0	

Scale (1 = not important, 7 = very important)

Dimension and Components

Red oak, white oak, hard maple, cherry, ash, and soft maple were determined to be "traditional" species within the wood components market segment. Gum, hickory, hybrid poplar, and yellow birch are "non-traditional" species that are currently being used in this segment. Hickory is a species that will continue to be used because of the demand for these component parts to be placed into cabinets. There were three respondent

companies that were classified as “traditional” users and 32 respondent companies were considered to be “non-traditional” species users, which had a species mix that consisted of more than 5% “non-traditional” species. This market segment had a low number of “traditional” respondents. This is due to the wide variety of species most dimension and component manufacturers produce. Because of this variety most manufacturers were classified into the group with more than 5% of their production being “non-traditional” species. Within this market segment “traditional” species users were consuming 7.5 million board feet of lumber a year on average and “non-traditional” species companies were using 3.5 million on average.

The attribute that displayed a significant difference between the two categories was blue/mineral stain-free (Table 4.7). “Non-traditional” species users viewed stain as a larger problem than the “traditional” users. This market segment had a low sample size for the “traditional” users category, which may cause the data to be inaccurate.

Table 4.7: Wood dimension and component market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Material Type	N	Mean	Significance Level
Machinability	Traditional	2	5.5	0.50
	Non-traditional	31	5.7	
Finishability	Traditional	2	5.0	0.82
	Non-traditional	32	4.8	
Straightness	Traditional	3	6.7	0.06
	Non-traditional	30	5.4	
Wane-free	Traditional	3	5.3	0.41
	Non-traditional	28	4.7	
Color	Traditional	3	6.0	0.57
	Non-traditional	31	5.4	
Proper dimensions	Traditional	3	6.0	0.45
	Non-traditional	30	6.4	
Blue/mineral stain-free	Traditional	2	2.5	**0.04**
	Non-traditional	30	5.7	
Lack of knots	Traditional	3	5.0	0.66
	Non-traditional	30	4.5	
Moisture Content (MC)	Traditional	3	4.3	0.12
	Non-traditional	31	5.7	
Consistency of MC	Traditional	3	4.0	0.07
	Non-traditional	30	5.7	
Low price	Traditional	3	4.7	0.50
	Non-traditional	30	5.0	
Price stability	Traditional	3	4.7	0.17
	Non-traditional	30	5.6	
On-time delivery	Traditional	3	5.0	0.27
	Non-traditional	30	5.9	
Consistent supply	Traditional	3	5.7	0.56
	Non-traditional	31	6.2	
Mechanical properties	Traditional	2	5.0	0.87
	Non-traditional	30	4.7	
Order lead-time	Traditional	2	5.0	0.75
	Non-traditional	30	5.2	

Scale (1 = not important, 7 = very important)

Windows and Doors

Red oak, hard maple, white pine, cherry, and ponderosa pine were determined to be "traditional" species within the windows and doors market segment. Some "non-traditional" species that displayed some significant use were hickory, radiata pine, yellow birch, and Douglas fir. The softwood species and the less durable hardwood species could be used in applications that are less demanding on the window or door, such as indoor applications. There were 10 respondent companies that were classified as "traditional" users and 25 respondent companies were considered to be "non-traditional"

species users. No significant differences were found between the two categories (Table 4.8).

Table 4.8: Windows and doors market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Traditional or Non-traditional	N	Mean	Significance Level
Machinability	Traditional	10	6.2	0.25
	Non-traditional	22	5.8	
Finishability	Traditional	10	6.1	0.53
	Non-traditional	22	5.8	
Straightness	Traditional	10	6.3	0.44
	Non-traditional	24	6.1	
Wane-free	Traditional	8	6.3	0.30
	Non-traditional	21	5.8	
Color	Traditional	9	4.6	0.35
	Non-traditional	23	5.3	
Proper dimensions	Traditional	10	5.8	0.65
	Non-traditional	22	5.6	
Blue/mineral stain-free	Traditional	9	5.5	0.39
	Non-traditional	23	5.5	
Lack of knots	Traditional	9	5.9	0.36
	Non-traditional	22	5.8	
Moisture Content (MC)	Traditional	9	6.1	0.37
	Non-traditional	24	6.2	
Consistency of MC	Traditional	9	5.9	0.38
	Non-traditional	24	5.8	
Mechanical properties	Traditional	9	4.6	0.23
	Non-traditional	22	5.3	
Order lead-time	Traditional	10	5.7	0.83
	Non-traditional	24	5.8	
Low price	Traditional	10	5.9	0.16
	Non-traditional	25	5.1	
Price stability	Traditional	10	5.9	0.39
	Non-traditional	25	5.4	
On-time delivery	Traditional	10	6.2	0.74
	Non-traditional	25	6.2	
Consistent supply	Traditional	10	6.6	0.25
	Non-traditional	25	6.3	
Service	Traditional	9	6.2	0.52
	Non-traditional	25	5.9	

Scale (1 = not important, 7 = very important)

Household Furniture

Red oak, white oak, cherry, ash, soft maple, hybrid poplar, yellow poplar, and ponderosa pine were determined to be "traditional" species within the household furniture market segment. Hard maple, white pine, southern yellow pine, radiata pine, and alder were the most used "non-traditional" species being used. The household furniture segment can use these species in many applications, such as non-visual components. There were 20 respondent companies that were classified as "traditional" users and 30 respondent companies were considered to be "non-traditional" species users. Within the household segment "non-traditional" species using companies are using more lumber on average. "Non-traditional" companies use 2.2 million board feet per year on average compared to 1.5 million for "traditional" users.

Consistency of moisture content was the one attribute that displayed a significant difference (Table 4.9). "Non-traditional" species users rated this attribute higher than the "traditional" users. Moisture content (MC) was also an attribute that was close to being significantly rated different by the two groups. The "non-traditional" species users within the household furniture segment desire a product that has a low and consistent MC. Blue/mineral stain-free displayed significant difference when using the Kruskall Wallis non-parametric testing, but did not display a difference when using ANOVA testing. "Non-traditional" users rated this attribute significantly higher.

Table 4.9: Household furniture market segment comparison between "traditional" and "non-traditional" species using companies.

Attribute	Traditional or Non-traditional	N	Mean	Significance Level
Machinability	Traditional	20	5.3	0.98
	Non-traditional	29	5.3	
Finishability	Traditional	20	5.6	0.90
	Non-traditional	28	5.5	
Straightness	Traditional	20	5.6	0.32
	Non-traditional	29	5.9	
Wane-free	Traditional	19	5.2	0.76
	Non-traditional	27	5.4	
Color	Traditional	20	5.6	0.96
	Non-traditional	27	5.7	
Proper dimensions	Traditional	19	6.2	0.52
	Non-traditional	28	6.3	
Blue/mineral stain-free	Traditional	19	5.2	**0.04***
	Non-traditional	28	5.9	
Lack of knots	Traditional	20	5.2	0.36
	Non-traditional	28	5.5	
Moisture Content (MC)	Traditional	19	5.6	0.07
	Non-traditional	29	6.4	
Consistency of MC	Traditional	19	5.6	**0.05**
	Non-traditional	27	6.4	
Mechanical properties	Traditional	19	5.1	0.67
	Non-traditional	27	4.7	
Order lead time	Traditional	20	5.4	0.85
	Non-traditional	27	5.5	
Low price	Traditional	19	5.5	0.55
	Non-traditional	30	5.7	
Price stability	Traditional	18	5.3	0.19
	Non-traditional	29	5.7	
On-time delivery	Traditional	19	5.8	0.37
	Non-traditional	30	6.2	
Consistent supply	Traditional	18	6.0	0.38
	Non-traditional	30	6.2	
Service	Traditional	17	6.1	0.73
	Non-traditional	30	6.0	

Scale (1 = not important, 7 = very important)

*** Represents difference between ANOVA significance level and Non-Parametric significance level. ANOVA testing did not indicate significance.**

Conclusions

The secondary industry contained a large amount of companies that were using over 5% of their individual market segment's "non-traditional" species. This displays that these alternative species can be used. Yet, within the seven market segements the most lumber used was still the "traditional" species. The respondent companies that were categorized as "traditional" species users were using more lumber than the "non-

traditional" companies. Companies that currently use "non-traditional" lumber will need to continually change their species mix in the direction of more "non-traditional" species. The companies that will be able to adopt the "non-traditional" species with the greatest of ease will be the companies that already use some of these species.

The issue of supply needs to be addressed before many of these companies will be willing to use more "non-traditional" species. The majority of the market segments rated this attribute the most important. Within the overall secondary industry there was a significant difference between the importance that "traditional" species users placed on consistent supply and the importance that "non-traditional" species users placed on this attribute. "Non-traditional" species users were more concerned with having a consistent supply of their raw material and component products. For "non-traditional" species to be successful within the wood secondary industry, a proven supply line must first be established.

Component manufacturers that want to begin producing more "non-traditional" species will have to be leaders in service, supply, on-time delivery, and order lead-time. An example of this type of manufacturing will be Just-In-Time (JIT) manufacturing. Companies that use this type of manufacturing and delivery system will be able to compete in the "non-traditional" species market. "Non-traditional" users rated these attributes higher in many of the six component consuming market segments. This indicates that companies purchasing "non-traditional" wood components demand that their supplier be a sales and marketing oriented firm. If a component manufacturer wants to compete with "traditional" manufacturers they will need to display that they are a quality distributor of their product.

While most market segments indicated that low price was not a very important issue, this is still an area where "non-traditional" species would be able to compete. The office furniture market segment's "non-traditional" species users significantly rated low price more important than "traditional" users. If component-producing companies can produce a lower priced component with "non-traditional" species then office furniture manufacturers may be willing to use it.

"Non-traditional" species using flooring manufacturers indicated that they demand less knots and wane in their products. When trying to compete in a market segment that is predominately lower grades of red oak, white oak, and hard maple, a company will need to differentiate their product. One way "non-traditional" species could compete is by showing that higher grades of these species can be used at the same or lower prices than the "traditional" species.

Millwork is an market segment where the use of "non-traditional" species can be implemented easily. The attributes that are rated most important in this segment are moisture content, consistency of moisture content, service, consistent supply, and lack of knots. "Non-traditional" species can compete with "traditional" species in each of these categories. Millwork is used in decorative applications that usually do not require a mechanically strong material. Most "non-traditional" species can be purchased at lower prices and manufactured and finished into a beautiful piece of wood. Component manufacturers will need to display to this market segment that they can produce a product that serves the millwork segments needs with these "non-traditional" species.

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Chapter 5

Conclusions

Secondary manufacturers of wood products are currently enduring a problem of decreased availability of their raw material. This has caused many manufacturers to begin to use lower grades or pay higher prices for their raw material. Most of these manufacturers are using what can be considered "traditional" species, either because this is what they are accustomed to or because of customer demands and pressure. Many "non-traditional" species exist in abundance in both the US and Canada. These species are currently being under-utilized. In many instances these species could be substituted for the "traditional" species allowing a company to save money and use higher quality wood material.

The first objective was to estimate the percentage of "non-traditional" species use in the secondary industry. "Traditional" species for the secondary industry were found to be red oak, white oak, hard maple, cherry, ponderosa pine, and yellow poplar. Analysis showed that the secondary industry is using a majority of "traditional" species to manufacture their products. For the industry as a whole, oak was the most popular species, which included the use of both red and white oak. Red oak average board footage use was calculated to be 1.3 million per year in the secondary industry. Many of the properties of oak, which are considered valuable, are its color and mechanical properties. The research indicated that the secondary industry rated both of these attributes much lower than other attributes desired in their wood components. This possibly shows that the industry is just using "traditional" species because of tradition

and consumer demand. If consumers could be educated on the properties of other species the industry may be more adept to change their species selection.

"Non-traditional" species, which include any species other than the six that are listed above, accounted for only 28.5% of the species mix. There is a large potential for many of these "non-traditional" species to be used and raise their share of the species mix. Within the secondary industry there were 190 companies using "non-traditional" species. This indicates that most companies have the ability to produce products made of these species. For the companies that already use these alternative species they would not have to change their operation very dramatically to begin to produce larger amounts of wood products containing these species.

Objective 2 was to identify wood component manufacturers' and component consuming market segments' perceptions on increased use of "non-traditional" wood species. The seven market segments were individually analyzed and "traditional" species were chosen for the segments independently. "Traditional" species for the component manufacturing market segment were determined to be red oak, white oak, hard maple, cherry, ash, and soft maple. These species are being used in production because of consumer demand. The component segment sells most of its products to the household furniture and cabinet segment. Both of these markets are driven by fashion trends and what consumers view as "in-style." The component segment will produce more wood products from "non-traditional" species when customers (i.e., the six other market segments that were surveyed) begin to make finished goods with these species.

The six wood component consuming market segments were separated and each was denoted their "traditional" species. The one species that every market segment had

on this list was red oak. This species was used the most in all of the market segments. Other species that were included in many of the segments' "traditional" list were hard and soft maple, poplar, cherry, and white oak. Each segment differed, but these were the main species being used. The six component consuming market segments viewed the use of "non-traditional" species in the same general way. They were currently using the species that the consumer demanded. They stated that the consumer's perception of the "traditional" species was one of quality. Many of the respondents stated that their company would gladly use other species, but at this time there was no one to sell that product to. Designers and architects will have to begin to request these alternative species before these segments will produce any products that are made from them.

The third objective was to identify the differences between companies that use "non-traditional" species and those companies that do not. "Non-traditional" species and "non-traditional" species users were identified for each individual market segment and the overall secondary wood products industry. A "non-traditional" species was defined as any species that made up less than 5% of the species mix in each individual segment. This allowed for "non-traditional" species to be identified within each market segment that was surveyed. The 5% cut-off was also used to determine what respondent companies were considered a "non-traditional" species user. A respondent company whose species mix was made up of 95% or more of their segments particular "traditional" species would be placed into the group of "traditional" users. The companies that used more than 5% of "non-traditional" species would be placed into the other group, which were "non-traditional" species users. Within the secondary wood products industry there

were 80 companies that were categorized as "traditional" and 190 that were "non-traditional."

Consistent supply was one attribute that was rated higher by many segments' "non-traditional" species users. The issue of supply will need to be addressed before many of these companies will be willing to use more "non-traditional" species. Within the overall secondary industry there was a significant difference between the importance that "traditional" species users placed on consistent supply and the importance that "non-traditional" species users placed on this attribute. "Non-traditional" species users were more concerned with having a consistent supply of their raw material and component products. For "non-traditional" species to be successful within the secondary wood products industry, a proven supply line must first be established.

Next I sought to develop recommendations for using "non-traditional" species in wood components manufacture. There is a potential to use "non-traditional" species in all of the markets that were surveyed. The millwork segment displays the most potential. This market segment already uses a wide variety of wood species, which shows there is no dominate species that is desired. The segment produces a product that is used in decorative applications that usually do not require specific mechanical properties. The ability of a species to be color matched and properly finished will determine if that species can be successfully used in this market segment.

The office furniture segment indicated that cost is a major factor in determining what species of wood they use in their products. "Non-traditional" species can be used in many office furniture applications at a lower cost than the "traditional" species.

Companies that wish to compete on price would be able to use these species and lower their raw material cost.

The cabinet market segment currently uses approximately 30% of the wood components that are being produced. This segment used "traditional" species because that is what their customers demanded. However this segment does use many component parts that are "hidden." "Non-traditional" species that have the ability to color match or ones that can be finished to resemble the "traditional" species can be used to lower the cost of producing cabinets. Hickory is one "non-traditional" species that has been introduced in this segment through trade shows. Many consumers have begun to request this species for their custom cabinets.

Each of the six wood component consuming market segments is driven by fashion. If "non-traditional" species are going to be used in these segments then they will have to be shown to be fashionable. It will have to be shown to architects and designers that they can use these species in their creations and still have a quality product. As these architects and designers begin to use these species consumers will begin to ask for them. Consumers requesting the use of these species will allow the six wood component consuming segments to produce products with these species. As the wood component consuming segments begin to manufacture using "non-traditional" species, they will begin to request components made from these new species. As this begins to happen the wood component manufacturers will produce more components made from these "non-traditional" species.

Implications for the Secondary Wood Products Industry

The secondary wood products industry has become increasingly competitive due to consolidation a slower economy. This competition means companies need to differentiate their product so they can compete. The use of "non-traditional" species is a way that companies that are looking for a competitive advantage can use. The use of a "non-traditional" species does not mean that a company will begin to make an inferior product, just a different one. Many species that are currently not being used have many of the desired attributes that the "traditional" species have. Companies that use these species will also be able to compete at a lower cost. Because many of the "non-traditional" species are not being used, they can be purchased as a less expensive raw material.

The raw material resource base is changing. Many of the "traditional" species that are being harvested are of lesser quality and size than those that were harvested in the past. The use of "non-traditional" species could aid in this problem in two ways. First, using other species could be less of a burden on the "traditional" species, which would allow them to grow for longer periods of time in turn producing better quality wood products. There is currently an abundance of the "non-traditional" species growing in the US and Canada that are not being used. This surplus would allow for companies to obtain this resource with less use of "traditional" species.

This research will be useful for both the secondary wood products industry and both the suppliers of the wood raw material and the consumers of the finished goods. The research has shown that secondary manufacturers are willing to use "non-traditional" species. Timber harvesters and sawmills have been supplying the species that they can

sell to the secondary manufacturers. This research indicated that if they can display to the secondary industry that there can be a consistent supply of "non-traditional" raw material then the industry would be able to use it. Consumers can be aided by this research by seeing that there is a desire from the secondary wood products industry to use "non-traditional" species.

Opportunities for Future Research

This research has shown that a market for "non-traditional" species is not fully developed in the secondary wood products industry. The research indicated that most wood being used is from a small number of species, which means that a majority of the species are being underutilized. Indications that smaller companies were more likely to use "non-traditional" species were found. This research also indicated that there were differences among the different market segments in the amounts and types of species being used.

This research indicated that many market segments within the secondary wood products industry require a consistent supply of raw material. In many instances this attribute was rated the most important reason a company chose a species to use. Further research will need to be conducted to see how the supply of "non-traditional" species will work. Other attributes that will need to be expanded on are the price of these "non-traditional species. It has been indicated that these species are less expensive than the "traditional" ones, but exact figures will need to be gathered.

Mechanical properties of the species will also need to be presented to help companies choose a species that best suits their needs. Most of these "non-traditional" species have their mechanical properties listed in many publications. This information

will need to be gathered and presented to the secondary industry. Future research could also be done on what type of products can be made from these species. Using these species in some applications by designers and architects will allow for the display of the species and their products.

This research was focused on the wood component manufacturers and the wood component consuming market segments. More research will need to be done on the raw material end of the supply chain, which would include the sawmills and timber harvesting companies perception on "non-traditional" species. Research will also need to be focused on the final consumers of wood products. This would include retail stores that sell wood products along with the perceptions felt by consumers who would purchase these wood products.

Limitations of this Study

The data was gathered from a large population, which included many different types and sizes of companies. This data should be viewed cautiously. The response rate for this survey was lower than expected, especially in the wood windows and doors market segment. Reasons for the low response rate could be attributed to the frequency that these market segments are surveyed, and the frequency that these sample populations are used by Virginia Tech for research. Questions that dealt with percentages of species used should also be viewed cautiously. Each individual market segment questionnaire can be seen in Appendix A.

The research was focused on the secondary wood products industry and did not include the perceptions of "non-traditional" species use felt by the raw material suppliers and the consumers.

APPENDIX A: SURVEY QUESTIONAIRES

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 1

1. What is the primary product produced at this facility?

- ❑ Cabinets
- ❑ Other -- Please specify:

_____

2. In addition to cabinets, does your company produce other wood products at this facility that you market and sell?

- ❑ No -- Go to question #3
- ❑ Yes (Check all that apply)
  - o Dimension parts / Components
  - o Flooring
  - o Wood office furniture
  - o Wood household furniture
  - o Millwork
  - o Windows/Doors
  - o Other -- Please specify:

_____

3. Please check the one box that best describes what type of cabinets your firm manufactures.

- ❑ Stock cabinets
- ❑ Semi-custom cabinets
- ❑ Custom cabinets
- ❑ We do not manufacture cabinets

Raw Material Use

4. Please indicate the percentage of each type of solid lumber used at this facility.

Hardwood Lumber	____%
Softwood Lumber	____%
Total	____*%*

5. What percentage of each of the following materials do you use at this facility?

Particleboard	____%
MDF	____%
Hardboard	____%
OSB	____%
Hardwood Plywood	____%
Softwood Plywood	____%
Edge-Glued Panels or Cut-to-size Blanks	____%
Veneer	____%
Other -- Please specify: _____	____%
Total material	***100%***

6. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

7. What percentage of your wood component needs are manufactured in-house compared to buying components from other manufacturers?

In-house	____%
Outsourced	____%
Total	***100%***

8. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

9. Please indicate the percentage of each type of wood component finish (i.e., degree of value-added) you purchase at this facility.

Blanks	____%
Semi-finished	____%
Finished	____%
Total	***100%***

10. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

11. What are the major factors you consider when choosing which species of wood to use in the manufacturing of your product?

- ❑ Cost
- ❑ Ease of use
- ❑ Customer demand (style)
- ❑ Supply
- ❑ Other -- Please specify:

_____

12. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

13. What are the important attributes in the components/component supplier you use?

	Not Important						Very Important
Machinability	1	2	3	4	5	6	7
Finishability	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper dimensions	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Mechanical properties	1	2	3	4	5	6	7
Order lead time	1	2	3	4	5	6	7

14. Please rate the importance to the following attributes concerning the purchase of wood components.

	Not Important						Very Important
Low price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Service	1	2	3	4	5	6	7

Processing Technology

15. Do you currently participate in any type of E-business (i.e., using the internet to sell/promote your product)?

- ❑ No
- ❑ Yes -- Please specify:

_____

_____

16. Within the past 5 years, what new technology (equipment/processes) has your company installed at this facility? (i.e., level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

17. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

18. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other -- Please explain:

_____

19. What is your average production lead-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

20. On a 7-point scale, how would you describe production flow in your organization?

Highly variable/ Intermittent **Smooth/ Continuous**

1 2 3 4 5 6 7

Company Demographics

21. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

22. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- Please specify the associations:

_____

_____

23. What were the total gross sales for your company (entire company, not just this production facility) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

24. How many full-time employees work for your company at this production facility? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

Comments and Suggestions

25. Are there any specific barriers or complications to utilizing "non-traditional" species in wood components that we have not addressed?

26. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 2

1. What is the primary product produced at this facility?

- ❑ Flooring
- ❑ Other -- Please specify:

_____

2. In addition to wood flooring, does your company produce other wood products at this facility that you market and sell?

- ❑ No -- Go to question #3
- ❑ Yes (Check all that apply)
  - o Dimension parts / Components
  - o Wood office furniture
  - o Cabinets
  - o Wood household furniture
  - o Millwork
  - o Windows/Doors
  - o Other --Please specify:

_____

3. What type of wood flooring do you produce at this facility? Please specify the volume of each type produced, as a % of total flooring material produced.

Solid hardwood	____%
Solid softwood	____%
Engineered flooring	____%
Please specify your product:	
_____	
Other -- Please specify:	____%
_____	
Total =	***100%***

Raw Material Use

4. Please indicate the percentage of each type of solid lumber used at this facility.

Hardwood Lumber	____%
Softwood Lumber	____%
Total	***____%***

5. What percentage of each of the following materials do you use at this facility?

Particleboard	____%
MDF	____%
Hardboard	____%
OSB	____%
Hardwood Plywood	____%
Softwood Plywood	____%
Edge-Glued Panels or Cut-to-size Blanks	____%
Veneer	____%
Other -- Please specify:	
_____	____%
Total material	***100%***

6. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

7. What percentage of your wood component needs are manufactured in-house compared to buying components from other manufacturers?

In-house	____%
Outsourced	____%
Total	***100%***

8. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

_____

9. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

10. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

11. What are the major factors considered when choosing which species of wood to use in the manufacturing of your product? (You may choose more than one.)

- ❑ Cost
- ❑ Ease of use
- ❑ Customer demand (style)
- ❑ Supply
- ❑ Other -- Please specify:

_____

12. What are the important attributes in the components/component supplier you use?

	Not Important						Very Important
Machinability	1	2	3	4	5	6	7
Finishability	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper dimension	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Mechanical Properties	1	2	3	4	5	6	7
Order lead-time	1	2	3	4	5	6	7

13. Please rate the importance to the following attributes concerning the purchase of wood components.

	Not Important						Very Important
Low Price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Service	1	2	3	4	5	6	7

Processing Technology

14. Do you currently participate in any type of E-business (i.e., using the internet to sell/promote your product)?

- ❑ No
- ❑ Yes -- Please specify:

_____

15. Within the past 5 years, what new technology (equipment/processes) has your company installed at this facility? (i.e., level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

16. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

17. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other -- Please explain:

_____

18. What is your average production lead-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

19. On a 7-point scale, how would you describe production flow in your organization?

Highly variable/ Intermittent						**Smooth/ Continuous**
1	2	3	4	5	6	7

Company Demographics

20. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

21. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- Please specify the associations:

_____

_____

22. What were the total gross sales for your company (entire company, not just this production facility) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

23. How many full-time employees work for your company at this production facility? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

Comments and Suggestions

24. Are there any specific barriers or complications to utilizing "non-traditional" species in wood components that we have not addressed?

25. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 3

1. What is the primary product produced at this facility?

- ❑ Millwork
- ❑ Other -- Please specify:

_____

2. In addition to millwork, does your company produce other wood products at this facility that you market and sell?

- ❑ No – Go to question #3
- ❑ Yes (Check all that apply)
  - o Dimension parts / Components
  - o Cabinets
  - o Flooring
  - o Wood office furniture
  - o Wood household furniture
  - o Windows / Doors
  - o Other -- Please specify:

_____

3. Please check the one box that best describes what type of millwork your firm manufactures.

- ❑ Stair parts
- ❑ Mouldings and assorted trim
- ❑ Other -- Please specify:

_____

Raw Material Use

4. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

5. Please indicate the percentage of each type of solid lumber used at this facility.

Hardwood Lumber	____%
Softwood Lumber	____%
Total	____*%*

6. What percentage of each of the following materials do you use at this facility?

Particleboard	____%
MDF	____%
Hardboard	____%
OSB	____%
Hardwood Plywood	____%
Softwood Plywood	____%
Edge-Glued Panels or Cut-to-size Blanks	____%
Veneer	____%
Other -- Please specify: _____	____%
Total material	***100%***

7. What percentage of your wood component needs are manufactured in-house compared to buying components from other manufacturers?

In-house	____%
Outsourced	____%
Total	***100%***

8. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

_____

9. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

10. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

11. What are the major factors considered when choosing which species of wood to use in the manufacturing of your product? (You may choose more than one)

- ❑ Cost
- ❑ Ease of use
- ❑ Customer demand (style)
- ❑ Supply
- ❑ Other -- Please specify:

_____

12. Please indicate the percentage of each type of wood component finish (i.e., degree of value-added) you purchase at this facility?

Blanks	____%
Semi-finished	____%
Finished	____%
Total	***100%***

13. What are the important attributes in the components/component supplier you use?

	Not Important						Very Important
Machinability	1	2	3	4	5	6	7
Finishability	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper dimension	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Mechanical properties	1	2	3	4	5	6	7
Order time	1	2	3	4	5	6	7

14. Please rate the importance to the following attributes concerning the purchase of wood components.

	Not Important						Very Important
Low price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Service	1	2	3	4	5	6	7

Processing Technology

15. Do you currently participate in any type of E-business (i.e., using the internet to sell/promote your product)?

- ❑ No
- ❑ Yes -- Please specify:

_____

_____

16. Within the past 5 years, what new technology (equipment/processes) has your company installed at this facility? (i.e., level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

17. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

18. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other --Please explain:

_____

19. What is your average production-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

20. On a 7-point scale, how would you describe production flow in your organization?

Highly variable/ Intermittent						**Smooth/ Continuous**
1	2	3	4	5	6	7

Company Demographics

21. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

22. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- Please specify:

_____

_____

23. What were the total gross sales for your company (entire company, not just this production facility) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

24. How many full-time employees work for your company at this production facility? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

Comments and Suggestions

25. Are there any specific barriers or complications to utilizing "non-traditional" species in wood components that we have not addressed?

26. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 4

1. What is the primary product produced at this facility?

- ❑ Wood office furniture
- ❑ Other -- Please specify:

_____

2. In addition to wood household furniture, does your company produce other wood products at this facility that you market and sell?

- ❑ No – Go to question #3
- ❑ Yes (Check all that apply)
  - o Dimension parts / Components
  - o Flooring
  - o Cabinets
  - o Wood household furniture
  - o Millwork/Windows/Doors
  - o Other -- Please specify:

_____

Raw Material Use

3. Please indicate the percentage of each type of solid lumber used at this facility.

Hardwood Lumber	____%
Softwood Lumber	____%
Total	***____%***

4. What percentage of each of the following materials do you use at this facility?

Particleboard	____%
MDF	____%
Hardboard	____%
OSB	____%
Hardwood Plywood	____%
Softwood Plywood	____%
Edge-Glued Panels or Cut-to-size Blanks	____%
Veneer	____%
Other -- Please specify: _____	____%
Total	***100%***

5. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

6. What percentage of your wood component needs are manufactured in-house compared to buying components from other manufacturers?

In-house	____%
Outsourced	____%
Total	***100%***

7. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

8. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

9. What are the major factors considered when choosing which species of wood to use in the manufacturing of your product?

- ❑ Cost
- ❑ Ease of use
- ❑ Customer demand (style)
- ❑ Supply
- ❑ Other -- Please specify:

_____

10. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

11. Please indicate the percentage of each type of wood component finish (i.e., degree of value-added) you purchase at this facility.

- ❑ Blanks ____%
- ❑ Semi-finished ____%
- ❑ Finished ____%

Total ____***%***

12. What are the important attributes in the components/component supplier you use?

	Not Important						**Very Important**
Machinability	1	2	3	4	5	6	7
Finishability	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper dimension	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Mechanical properties	1	2	3	4	5	6	7
Order lead time	1	2	3	4	5	6	7

13. Please rate the importance to the following attributes concerning the purchase of wood components.

	Not Important						**Very Important**
Low price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Service	1	2	3	4	5	6	7

Processing Technology

14. Do you currently participate in any type of E-business (i.e., using the internet to sell/promote your product)?

- ❑ No
- ❑ Yes -- Please specify:

_____

_____

15. Within the past 5 years, what new technology (equipment/processes) has your company installed at this facility? (i.e., level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

16. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

17. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other -- Please explain:

_____

18. What is your average production lead-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

19. On a 7-point scale, how would you r describe production flow in your organization?

Highly variable/ Intermittent						**Smooth/ Continuous**
1	2	3	4	5	6	7

Company Demographics

20. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

21. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- Please specify the association:

_____

_____

22. What were the total gross sales for your company (entire company, not just this production facility) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

23. How many full-time employees work for your company at this production facility? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

Comments and Suggestions

24. Are there any specific barriers or complications to utilizing "non-traditional" species in wood components that we have not addressed?

25. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 5

1. What is the primary product produced at this facility?

- ❑ Dimension parts / Components / Wood blanks
- ❑ Other -- Please specify:

_____

2. In addition to dimension parts / components / wood blanks, does your company produce any finished (consumer ready) wood products at this facility?

- ❑ No -- Go to question #3
- ❑ Yes (Check all that apply)
  - o Flooring
  - o Cabinets
  - o Wood office furniture
  - o Wood household furniture
  - o Millwork
  - o Windows/Doors
  - o Other wood products -- Please specify:

_____

Raw Material Use

3. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

4. What percentage of your lumber input is hardwood and how much is softwood?

Hardwood	____%
Softwood	____%
Total	***100 %***

5. Please indicate the percentage of each type of solid raw material used at this facility.

Logs	____%
Cants	____%
Rough green lumber	____%
Rough kiln dried lumber	____%
Surfaced four sides boards	____%
Surface two sides boards	____%
Edged one side boards	____%
Edged two sides boards	____%
Precision end-trim boards	____%
Total	***100 %***

6. How many square feet of panel products does your facility utilize per year?

_____Square feet

7. What percentage of each type of panel product do you use?

Softwood plywood	____%
Hardwood plywood	____%
MDF	____%
Particleboard	____%
Other -- Please specify:	
_____	____%
Total	***100 %***

8. Has your company changed its primary type of raw material (lumber and panels) used in the last 5 years?

- ❑ No
- ❑ Yes

If yes, please specify what type of change has occurred.

_____

_____

9. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

10. What best describes your lumber processing strategy?

- ❑ Try to obtain highest yield possible from lower grades of lumber
- ❑ Purchase high-grade lumber only

11. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

12. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

Components Produced

13. Please indicate the percentage of each type of wood component finish (i.e., degree of value-added) you produce at this facility?

Blanks	____%
Semi-finished components (profiled, shaped, ect.)	____%
Finished components	____%
Total	***100 %***

14. Of all the components and blanks you produce, what percentage will be used in visual applications versus non-visual applications, such as internal furniture parts or industrial applications?

Visual Applications	____%
Non-visual Applications	____%
Total	***100 %***

15. What percentage of your wood raw material input volume is obtained from:

Company owned/affiliated sources	____%
Outside vendors	____%
Other -- Please specify:	
_____	____%
Total	***100%***

16. What percentage of your product goes to each of the following industry segments?

❑ Cabinets	____%
❑ Flooring	____%
❑ Millwork	____%
❑ Windows & Doors	____%
❑ Office Furniture	____%
❑ Household Furniture	____%
❑ Other -- Please specify:	
_____	____%
Total	***100 %***

17. Please rate the importance of the following attributes you demand in the wood products you purchase.

	Not Important						**Very Important**
Machinability	1	2	3	4	5	6	7
Finishability	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper dimensions	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Low price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Mechanical properties	1	2	3	4	5	6	7
Order lead time	1	2	3	4	5	6	7

Processing Technology

18. Do you currently participate in any type of E-business (i.e., using the internet to sell your product)?

❑ No
❑ Yes -- Please specify:

_____

19. Within the past five years, what new technology (equipment/processes) has your company installed at <u>this facility</u>? (i.e., level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

20. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other -- Please explain:

_____

21. What is your average production lead-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

22. On a 7-point scale, how would you describe production flow in your organization?

Highly variable/ Intermittent **Smooth/ Continuous**

1 2 3 4 5 6 7

23. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

<u>Company Demographics</u>

24. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

25. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- Please specify the associations:

_____

_____

26. What were the total gross sales for your company (<u>entire company, not just this production facility</u>) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

27. How many full-time employees work for your company at <u>this production facility</u>? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

<u>Comments and Suggestions</u>

28. Are there any specific barriers or complications to utilizing "non-traditional" species in the manufacturing of wood components that we have not addressed?

29. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 6

1. What is the primary product produced at this facility?

- ❑ Windows and Doors
- ❑ Other -- Please specify:

_____

2. In addition to millwork, does your company produce other wood products at this facility that you market and sell?

- ❑ No – Go to question #3
- ❑ Yes (Check all that apply)
  - o Dimension parts / Components
  - o Cabinets
  - o Flooring
  - o Wood office furniture
  - o Wood household furniture
  - o Millwork
  - o Other -- Please specify:

_____

Raw Material Use

3. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

4. Please indicate the percentage of each type of solid lumber used at this facility.

Hardwood Lumber	____%
Softwood Lumber	____%
Total	____*%*

5. What percentage of each of the following materials do you use at this facility?

Particleboard	____%
MDF	____%
Hardboard	____%
OSB	____%
Hardwood Plywood	____%
Softwood Plywood	____%
Edge-Glued Panels or	
Cut-to-size Blanks	____%
Veneer	____%
Other -- Please specify:	
_____	____%
Total	***100%***

6. What percentage of your wood component needs are manufactured in-house compared to buying components from other manufacturers?

In-house	____%
Outsourced	____%
Total	***100%***

7. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

_____

8. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

9. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

10. What are the major factors considered when choosing which species of wood to use in the manufacturing of your product? (You may choose more than one)

- ❑ Cost
- ❑ Ease of use
- ❑ Customer demand (style)
- ❑ Supply
- ❑ Other -- Please specify:

_____

11. Please indicate the percentage of each type of wood component finish (i.e., degree of value-added) you purchase at this facility?

Blanks	____%
Semi-finished	____%
Finished	____%
Total	***100%***

12. What are the important attributes in the components/component supplier you use?

	Not Important						**Very Important**
Machinability	1	2	3	4	5	6	7
Finishability	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper dimension	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Mechanical properties	1	2	3	4	5	6	7
Order lead time	1	2	3	4	5	6	7

13. Please rate the importance to the following attributes concerning the purchase of wood components.

	Not Important						**Very Important**
Low price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Service	1	2	3	4	5	6	7

Processing Technology

14. Do you currently participate in any type of E-business (i.e. using the internet to sell/promote your product)?

- ❑ No
- ❑ Yes -- Please specify:

_____

15. Within the past 5 years, what new technology (equipment/processes) has your company installed at this facility? (level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

16. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

17. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other -- Please explain:

_____

18. What is your average production lead-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

19. On a 7-point scale, how would you describe production flow in your organization?

Highly variable/ Intermittent						**Smooth/ Continuous**
1	2	3	4	5	6	7

Company Demographics

20. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

21. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- please specify:

_____

22. What were the total gross sales for your company (entire company, not just this production facility) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

23. How many full-time employees work for your company at this production facility? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

Comments and Suggestions

24. Are there any specific barriers or complications to utilizing "non-traditional" species in wood components that we have not addressed?

25. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

With the cost of raw materials for the secondary hardwood industry increasing, many companies are seeking alternatives. The use of "non-traditional" species may be a viable way to compensate for rising production costs.

For this study, "non-traditional species" are defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are interested in what species you are currently using and the alternative species you may be able to use. Our objective is to identify the challenges and possible solutions to using "non-traditional" species. 7

1. What is the primary product produced at this facility?

- ❑ Wood household furniture
- ❑ Other -- Please specify:

_____

2. In addition to wood household furniture, does your company produce other wood products at this facility that you market and sell?

- ❑ No – Go to question #3
- ❑ Yes (Check all that apply)
  - o Dimension parts / Components
  - o Flooring
  - o Cabinets
  - o Wood office furniture
  - o Millwork/Windows/Doors
  - o Other -- Please specify:

_____

Raw Material Use

3. Please indicate the percentage of each type of solid lumber used at this facility.

Hardwood Lumber	____%
Softwood Lumber	____%
Total	____*%*

4. What percentage of each of the following materials do you use at this facility?

Particleboard	____%
MDF	____%
Hardboard	____%
OSB	____%
Hardwood Plywood	____%
Softwood Plywood	____%
Edge-Glued Panels or Cut-to-size Blanks	____%
Veneer	____%
Other -- Please specify: _____	____%
Total material	***100%***

5. What is your company's annual lumber input volume at this production facility in thousands of board feet?

_____MBM

6. What percentage of your wood component needs are manufactured in-house compared to buying components from other manufacturers?

In-house	____%
Outsourced	____%
Total	***100%***

7. Are you currently using any environmentally certified raw materials (i.e., third party evaluation to determine whether a company is managing the raw material in accordance with principles of sustainability)?

- ❑ No
- ❑ Don't know
- ❑ Yes -- Please specify the type of certification:

_____

_____

8. What percentage of each species does your company currently use at this facility?

Red Oak	____%
White Oak	____%
Hard Maple	____%
Cherry	____%
White Pine	____%
Ponderosa Pine	____%
"Non-traditional" species	
Hickory	____%
Ash	____%
Soft Maple	____%
Hybrid Poplar	____%
Southern Yellow Pine	____%
Radiata Pine	____%
Douglas Fir	____%
Yellow Birch	____%
Yellow Poplar	____%
Aspen	____%
White Birch	____%
Gum	____%
Alder	____%
Other species -- Please specify:	
_____	____%
_____	____%
All wood use	***100 %***

9. What are the major factors considered when choosing which species of wood to use in the manufacturing of your product?

- ❑ Cost
- ❑ Ease of use
- ❑ Customer demand (style)
- ❑ Supply
- ❑ Other -- Please specify:

_____

10. Please indicate the volume of each grade as a percentage of total material used.

Hardwood	%	Softwood	%
FAS		Select	
Selects		#1	
#1 Common		#2	
#2 Common		#3	
#3 A		Utility	
#3 B		Appearance	
Total	100 %	Total	100 %

11. Please indicate the percentage of each type of wood component finish (i.e., degree of value-added) you purchase at <u>this facility.</u>

- ❑ Blanks ____%
- ❑ Semi-finished ____%
- ❑ Finished ____%

Total ____***%***

12. What are the important attributes in the components/component supplier you use?

	Not Important						**Very Important**
Machinability	1	2	3	4	5	6	7
Finishabilty	1	2	3	4	5	6	7
Straightness	1	2	3	4	5	6	7
Wane-free	1	2	3	4	5	6	7
Color	1	2	3	4	5	6	7
Proper Dimension	1	2	3	4	5	6	7
Blue/mineral stain-free	1	2	3	4	5	6	7
Lack of knots	1	2	3	4	5	6	7
Moisture Content (MC)	1	2	3	4	5	6	7
Consistency of MC	1	2	3	4	5	6	7
Mechanical properties	1	2	3	4	5	6	7
Order lead time	1	2	3	4	5	6	7

13. Please rate the importance to the following attributes concerning the purchase of wood components.

	Not Important						**Very Important**
Low price	1	2	3	4	5	6	7
Price stability	1	2	3	4	5	6	7
On time delivery	1	2	3	4	5	6	7
Consistent supply	1	2	3	4	5	6	7
Service	1	2	3	4	5	6	7

<u>Processing Technology</u>

14. Do you currently participate in any type of E-business (i.e. using the internet to sell/promote your product)?

- ❑ No
- ❑ Yes -- Please specify:

_____

_____

15. Within the past 5 years, what new technology (equipment/processes) has your company installed at <u>this facility</u>? (i.e., level of automation, use of CNC, orders management, cutting bill optimization, bar codes, etc.)

Equipment
Processes

16. What percentage of your total cost is associated with your wood cost?

Wood raw material ____%

17. Please indicate how production is scheduled in your operation? (check one)

- ❑ Based on MRP (material requirement plan)
- ❑ Based on Kanban/supermarket system (pull production)
- ❑ Order expediting
- ❑ Other -- Please explain:

_____

18. What is your average production lead-time? (i.e., on average how long does it take for a product to travel through all processes in your operation, from raw material to finished goods?

_____Days

19. On a 7-point scale, how would you describe production flow in your organization?

Highly variable/ Intermittent						**Smooth/ Continuous**
1	2	3	4	5	6	7

Company Demographics

20. Is your facility part of a multiple facility company with more than one production site or is it a single operation?

- ❑ Part of a multiple facility company
- ❑ Single operation

21. Is your company a member of any trade associations that represent your industry?

- ❑ No
- ❑ Yes -- Please specify the associations:

_____

_____

22. What were the total gross sales for your company (entire company, not just this production facility) in 2002? (check one)

- ❑ Less than $1,000,000
- ❑ $1,000,000 - $5,000,000
- ❑ $5,000,001 - $15,000,000
- ❑ $15,000,001 - $25,000,000
- ❑ $25,000,001 - $50,000,000
- ❑ Greater than $50,000,000

23. How many full-time employees work for your company at this production facility? (check one)

- ❑ Fewer than 25
- ❑ 25 – 50
- ❑ 51 – 100
- ❑ 101 – 200
- ❑ 201 – 300
- ❑ 301 – 400
- ❑ Greater than 400

Comments and Suggestions

24. Are there any specific barriers or complications to utilizing "non-traditional" species in wood components that we have not addressed?

25. Is there anything else you wish to share with us concerning the use of "non-traditional" species within your industry?

Appendix B: Letters and Postcard

Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Department of Wood Science and Forest Products

1650 Ramble Rd - Mail Code 0503
Blacksburg, Virginia 24061
Phone: (540) 231-4525 Fax: (540) 231-8868
Email: pmcdanie@vt.edu

December 10th, 2002

«Production_Manager»
«Name»
«address»
«city», «state» «zip»

Dear Production Manager:

With the increasing cost of raw materials for the secondary hardwood industry many companies are seeking alternatives. Virginia Tech is in the process of conducting research on how many companies, such as yours, may benefit from the use of "non-traditional" species. For this study "non-traditional species" are being defined as any species that are not commonly used within the industry. More specifically, we are looking into the use of birch, aspen, gum, red maple, and softwoods.

We are currently in the process of pre-testing our questionnaire that will be sent out to many companies within your industry. For the pre-test we are asking that you please review the questionnaire carefully and point out any areas where the questionnaire may be unclear the questionnaire may have. We are especially checking to make sure that the questionnaire is readable and that all questions are understandable. Feel free to answer the questions as you go along, but it is not necessary that your do so.

I would like to thank you for your assistance in advance. When you have completed your review, please fax it to the following number (540) 231-8688. If you should have any questions, please contact me by phone at (540) 231-4525.

Sincerely,

Paul McDaniel
Graduate Student

Virginia Tech

Department of Wood Science and Forest Products

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Sincerely,

Paul McDaniel
Graduate Student

Dear Production Manager:

We need your help! Two weeks ago I mailed you a copy of a questionnaire dealing with the use of "non-traditional species" within your industry. I am contacting you to ask you to complete the questionnaire. If you have completed and returned it, please accept my sincere appreciation. The questionnaire is designed to gather information on the use of "non-traditional species" as a viable raw material. If you have not completed the questionnaire, please take a few minutes now to fill it out and return.

Since your name was chosen at random, your participation is critical for the success of the study. The information you provide will be kept strictly confidential. The number on the questionnaire allows us to remove your name from future mailings. If you have any questions, please contact me at 540-231-4525. Our fax number is 540-231-8868. Thank you in advance for your participation.

Sincerely,

Paul McDaniel
Graduate Student
Virginia Tech

Postcard

VITAE

Paul W. McDaniel, son of Danny C. McDaniel and Ellen McDaniel, was born in Radford, Virginia on May 18, 1979. After graduating from George Wythe High School in 1997, Mr. McDaniel attended Virginia Polytechnic Institute and State University where he received a Bachelor of Science degree Wood Science and Forest Products in 2001. Mr. McDaniel continued his education by earning a Master of Science degree in Forest Products Marketing from Virginia Polytechnic Institute and State University in 2003. Mr. McDaniel will begin his career as a loan officer with Farm Credit of the Virginia's in Wytheville, Virginia.