

**Analysis of Factors Impacting the International Value Chain of Hardwood
Products: A Comparison between Asia and Western Europe
FY 2011**

The exports of hardwood products will be vital for the U.S. hardwood industry to survive. The goal of this research was to obtain new market information using value chain analysis. An extensive literature review was conducted to identify key overseas markets for U.S. hardwood firms in Asia and Western Europe. With the assistance of the American Hardwood Export Council, secondary hardwood firms, government agencies, and non-profit organizations that support industry in the selected countries were visited to identify the factors that impact their hardwood value chains. The research team next investigated drivers and attitudes through a survey of U.S. hardwood exporters to Asia and Western Europe. Finally, the results were used to explore how demand management can be applied to increase profit in the export markets. Guidelines to support the marketing strategic process of U.S. hardwood industries by regions, products, species, and other factors were developed.

FINAL REPORT

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Analysis of Factors Impacting the International Value Chain of Hardwood Products: A Comparison between Asia and Western Europe

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Executive Summary

The goal of this research was to increase the exports of higher value products of hardwood firms in the U.S. by capturing new market information using value chain analysis. According to previous research, the exports of hardwood products will be vital for the U.S. hardwood industry to survive. To achieve the project's goal, three research phases were completed. In phase I, an extensive literature review from secondary sources was conducted to identify key overseas markets for U.S. hardwood firms in Asia and Western Europe. With the assistance of the American Hardwood Export Council (AHEC), secondary hardwood firms, government agencies, and non-profit organizations that support industry in the selected countries were visited to identify the factors that impact their hardwood value chains. In phase II, the research team investigated drivers and attitudes through a survey of U.S. hardwood exporters to Asia and Western Europe. Finally, in phase III, results from the previous phases were used to explore how demand management can be applied to increase profit in the export markets. In addition, guidelines were developed to support the marketing strategic process of U.S. hardwood industries by regions, products, species, and other factors.

Through a case study conducted for phase I in hardwood importing companies from selected trade fairs abroad:

- Four main dimensions were found to have a potential impact on export performance: characteristics of the Product, Service, Market and Firm (supplier).
- It was determined that product-related characteristics are the foundation for entering the export markets of hardwood products. However,
- It was also determined that any strategy intended to create competitive advantage should encompass specific plans to improve a firm's service level to meet the customers' expectations.

For a survey conducted in the second phase of this project, a total of twenty-seven responses were obtained from the members of NHLA.

- This study has confirmed that product quality and price remained as key components of the export strategies in Asia and Europe equally.
- Also revealed that aspects related to the service, such as lead time, on-time delivery, volume and species availability, among others, may have more relevance on improving the performance of U.S. hardwood exporters than other aspects related to the product itself.

In the third phase, historic sales data were analyzed in order to determine optimum pricing values for multiple products in each company.

- The results of the simulation indicate that for some products, it was possible to improve the revenue derived from products using the proposed pricing approach. However,
- The Optimization process itself presented mixed results, which should serve as an indication that not all hardwood products and markets may be suitable for this approach.
- Further research is recommended not only for product traded internationally, but for domestic transactions too, which will serve the sales and marketing groups in negotiating pricing with customers with customers.

Several dissemination activities such as workshops, trade publications, newsletters, and web publications were delivered as well. Currently the authors are in the process of submitting three peer-reviewed publications to selected journals. The outputs of this project will help to increase the exports of primary hardwood products in Virginia and the U.S. to secondary hardwood overseas markets, increase of employment opportunities, and an overall increase in the understanding and awareness of international marketing opportunities in Asia and Western Europe.

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1 Background

The goal of this project was to increase the exports of higher value hardwood products by capturing new market information using value chain analysis in traditional overseas U.S. export hardwood markets. The outputs of this project are intended to help U.S. hardwood industries discover more potential opportunities and build better marketing strategies for Asian and European hardwood markets.

1.1 U.S. Forest Resource Update

There are 751 million acres of forestland in the United States. Most of these forests (92 % approximately) are of natural origin (i.e. regenerated naturally from existing trees) while only 8 % is planted nationally. Most of planted forests (20 %) are located in the southern region. Approximately two-thirds (514 million acres) of U.S. forest are classified as timberland: forest capable of producing 20 cubic feet per acre of industrial wood a year and not legally reserved from forest harvest (Haynes & Pacific Northwest Research, 2007).

The majority of timber consumed by the wood manufacturing industry in United States comes from the harvest of local public and private forests lands. At least 56 % of U.S. forests are in private hands –approximately 423 million acres in 2007. These owners include the Forest industry and forest management companies, timber investment management organizations, and other companies that may or may not have forest management as a primary ownership objective. The remaining 44 % (328 million acres) are public, where the Forest Service and USDA manage most of them (W. B. Smith, Miles, Perry, Pugh, & United States. Forest Service., 2009). The harvest from public landowners is regulated by government agencies, and has historically proved not to be significantly sensitive to the timber market conditions. In contrast, harvest from private landowners is determined by timber market conditions and by the area available for timber production (Haynes & Pacific Northwest Research, 2007).

It has been estimated that United States timberland contains over one trillion cubic feet of timber, where 92 % is growing stock (i.e. live trees suitable for round wood products). The proportion of cull trees (i.e. wood not merchantable due to poor form or quality) is around 6 % of all timber volume, and approximately 2 % is in dead trees suitable enough for commercial trade.

Hardwoods account for 403 billion cubic feet (around 43 %) of all growing-stock in the United States, which means that the majority of growing-stock (57 %) is softwood (529 billion cubic feet). Most of softwood is concentrated in the West –the Pacific Coast Region which accounts for 43 % of all U.S softwoods growing stock –and almost the entire production of hardwood timber (90 %) comes from the Eastern States, where the southern central and northeastern regions are the largest producers. The northeastern region is expected to become the largest producer by 2015 according to USDA and Forest Service (W. B. Smith et al., 2009). Most of the remaining 10 % is located in the Pacific Coast Region. Private ownership of timber lands (corporate and non-corporate) accounts for 78 % of hardwood growing stocks in United States (41 % of softwoods).

More than thirty two species of domestic hardwoods are currently being exploited by manufacturing industry in U.S. (U.S. Forest Products Laboratory, 2010). Hardwood lumber is usually supplied directly from manufacturers, but also from wholesalers, brokers, and from lumber yards or building supply retailers in some cases (U.S. Forest Products Laboratory, 2010). Because of the considerable variety of hardwood species and products, suppliers tend to deal only with a limited amount of them. Table 1.1 provides an overview of major resources of U.S. hardwoods according to the geographical area (U.S. Forest Products Laboratory, 2010). All the top 10 hardwood species are found in eastern United States, with the exception of cottonwood and aspen, which are distributed throughout the country. Oak is the most common genus; it accounts for 125 billion cubic feet (31 % of all hardwood volume). Maples occupy the next place in abundance, accounting for 63 billion cubic feet (16 % of all hardwoods).

Table 1.1. Major resources of U.S. hardwoods per geographical region (U.S. Forest Products Laboratory, 2010)

Western	Northern and Appalachian	Southern
Alder, red	Ash	Ash
Ash, Oregon	Aspen	Basswood
Aspen	Basswood	Beech
Birch, paper	Beech	Butternut
Cottonwood	Birch	Cottonwood
Maple, bigleaf	Buckeye	Elm
Oak, California black	Butternut	Hackberry
Oak, Oregon white	Cherry	Hickory
Tanoak	Cottonwood	Honeylocust
	Elm	Locust, black
	Hackberry	Magnolia
	Hickory	Maple, soft
	Honeylocust	Oak, red and white
	Locust, black	Sassafras
	Maple, hard	Sweetgum
	Maple, soft	Sycamore
	Oak, red and white	Tupelo
	Sycamore	Walnut
	Walnut	Willow
	Yellow-poplar	Yellow-poplar

1.2 Hardwood Industry Business Performance

1.2.1 Domestic Market

The hardwood industry used to benefit from high production volumes –above 10 million board feet per year –particularly between years 1997 and 2005 (Hornsby, 2012). However, not only the hardwood production, but the entire wood manufacturing industry fell to historically low levels after the collapse in the U.S housing market and the economic meltdown in the final quarter of 2008 (HMR, 2012).

Housing starts (Figure 1.1, IBISWorld, 2012a), a critical hardwood business economic driver, were 554,000 in 2009: this is the lowest level observed in the last 50 years (Woodall et al., 2011) and represents only 27 % of the housing starts in 2005 (historical maximum), and 40 % of the

average of last 39 years. The U.S. hardwood production (Figure 1.2), which peaked in 1999 at an estimated 12.6 billion board feet (BBF), recorded in 2009 the lowest production since 1960 at 5.73 BBF –a drop of 55 % versus 1999 (Barford, 2012).

In general, wood related industries have shown a reduction in employment of 735,800 jobs between 2002 and 2011; 67% more than the transportation equipment manufacturing group (including automotive) for the same time period.

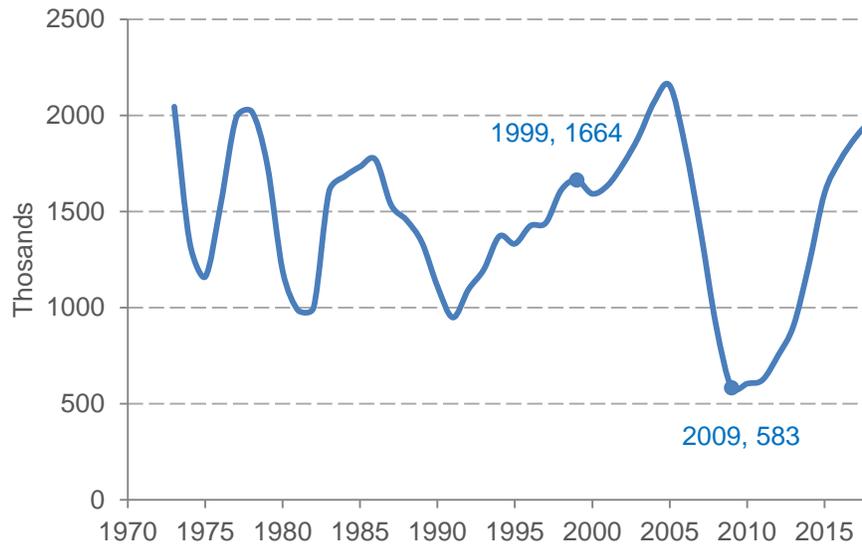


Figure 1.1. U.S. Housing Starts (IBISWorld)



Figure 1.2. Estimated U.S. Hardwood Lumber production, 1994-2011 (Hardwood Review, 2012b)

Despite of the efforts of the U.S. government to encourage economic expansion through stimulus spending, the economic growth slowed following cutbacks in the federal government cash infusions. For instance, the single-family housing starts did not perform well in 2011 compared to 2010, they showed a decrease of 10.1 % (HMR, 2012). New home completions, commonly

associated with sales of furnishing and interior fittings, and decreased 11.6 % in 2011 from 2010 (HMR, 2012). In general 2011 showed a decrease in consumption of furniture, moulding and millwork, cabinets, and flooring. The only industries that seemed to show positive trends in production and consumption through 2011 were Pallets, Railway Ties, Board Roads and Exports (HMR, 2012). U.S. hardwood industry has turned its sight to international markets, as an opportunity to replace some of the local demand lost after 2008 economic meltdown (Hornsby, 2012).

1.3 International Markets

1.3.1 Importance of Exports

Exports have not come to raise production levels to match 2007 records, but they have certainly become a key market for present and short term U.S. hardwoods production (HMR, 2012). International businesses represented 17.3% of the volume of all eastern U.S. hardwood production (1.2 BBF), which translated into a 46.5% of all grade lumber markets and 58.0% of the volume of mid- to upper-grade markets (Figure 1.3). Through October 2011, exports of hardwood lumber increased 10.4% over the first 10 months of 2010. Species being used by international markets are key to eastern U.S. suppliers: red oak, white oak, ash, walnut and yellow poplar (HMR, 2012). There is no question as to the growing importance of international markets; however it may also represent a risk of offshoring jobs of the secondary hardwood industry.

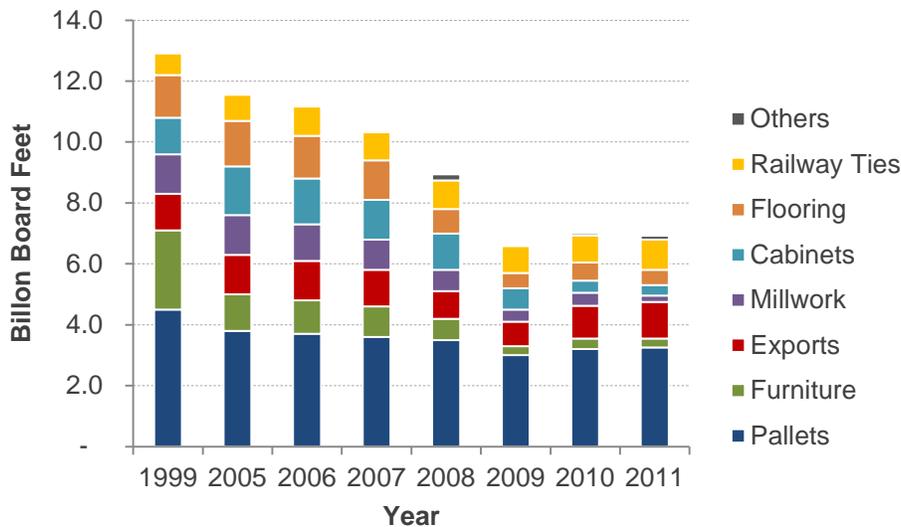


Figure 1.3. Estimated Consumption of U.S. Hardwoods (American Hardwood Export Council, 2011a)

1.3.2 Primary vs. Secondary Products

Even though the demand for U.S. hardwood has helped compensate for some of the domestic demand loss in the short and medium terms, it is possible that exporting raw materials (e.g. logs and lumber) represent a risk of off-shoring U.S. secondary jobs (Woodall et al., 2011). Figure 1.4 and Figure 1.5 depict the composition hardwood exports between 2006 and the first half of

2011. It is evident that most of U.S. hardwood international trade consists of primary products such as logs and lumber: together they represent almost 80 % of total volume traded –with worldwide market share of 14.7 % – the United States is the world’s largest exporter of hardwood lumber (Woodall et al., 2011). U.S. hardwood lumber exports totaled 107 million board feet (MMBF) in July 2012, besting July 2006 by almost 10% to set a new record (June exports were just 0.8% below the June record, also set in 2006) (Hardwood Review, 2012a), which reinforces the notion that demand for U.S. hardwood primary products such as lumber, not only remain remains strong, but as it will be covered in next section, still represents an opportunity for growth in this industry sector, which in turn may translate into a jobs creation. The purpose of this research was to explore such opportunities for growth in the export market.

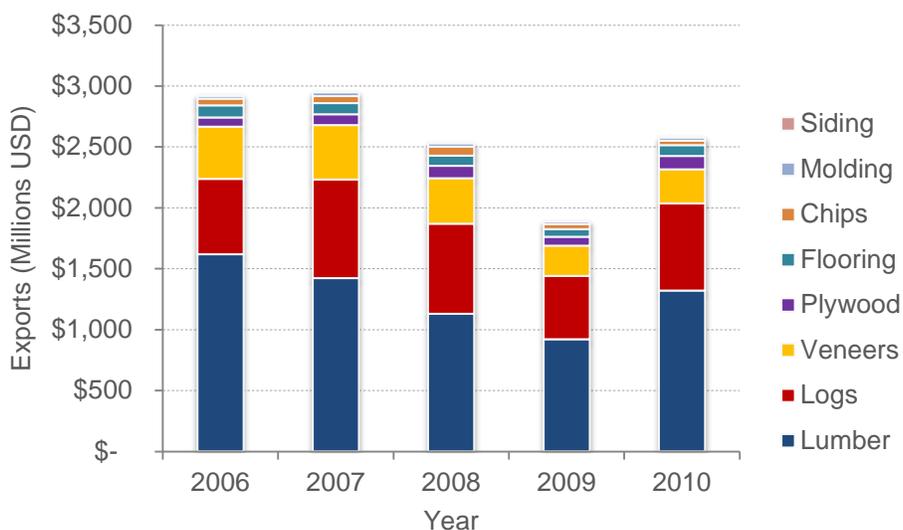


Figure 1.4. U.S. Hardwood Exports By Product: 2006-2010 (American Hardwood Export Council, 2011a)

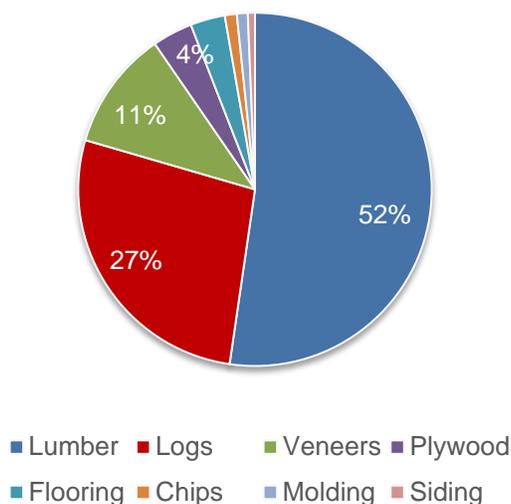


Figure 1.5. U.S. Hardwood Exports By Product: First Semester 2011 (American Hardwood Export Council, 2011b)

1.4 Justification

Firms need to understand what it takes to be successful exporters in order to take full advantage of the opportunities previously mentioned. Even though there has been extensive research on export performance, this field of international business still is characterized by fragmentation, diversity and inconsistency in results. Most of previous research has been focused on multiple industries, rather than on single industries, and studies on export performance in hardwood products are practically nonexistent. A comprehensive export performance theory is yet to be defined, and specific aspects of operations management such as demand management and manufacturing environments are yet to be studied, particularly in the hardwood industry.

A better understanding of the factors affecting the performance of exports in overseas markets is necessary for the U.S. primary hardwood producers to develop specific marketing strategies by region according to current customer trends in those markets. What is known to U.S. firms is that in today's environment, the focus is shifting towards value addition and waste elimination (Mehra & Inman, 2004). Cost-based practices of the past should be replaced by value-chain focus in today's organizations.

The U.S. hardwood exporters feel comfortable and knowledgeable about the market conditions in Canada and Mexico, which together account for 24 % of U.S. hardwood products exports. Even though hardwood exports to Asia and Western Europe represent more than 60% of total hardwood exports, these markets are full of potential opportunities for U.S. hardwood producers for value-added products. For instance, data collected and analyzed by AHEC shows that the first two destinations for U.S. hardwood lumber and logs are China and Vietnam. These two countries have become the leaders in supplying furniture to the U.S. market with a positive trade balance in their favor of \$12.4 and \$1.4 billion, respectively (see Figure 1). Fascinatingly, most of that furniture is manufactured using U.S. hardwoods as raw materials. A similar situation is the case of Italy, the United Kingdom, and Germany (top U.S. hardwood lumber and logs importers in Western Europe) that import raw materials from the U.S. to produce high-end market furniture where the majority is shipped back to the U.S.

As the previous statistics and trends show, it seems that there is an opportunity for U.S. hardwood producers to learn more about the value chains in the mentioned countries. It is anticipated that productivity and macro-economic issues are the largest drivers that cause the unbalance for the U.S. (see Figure 1.6), but there may be other social, cultural, and regulatory factors in those countries' value chains that might not be well understood by U.S. hardwood producers. This lack of understanding of those overseas value chains could be impairing the ability of U.S. hardwood producers to be more aggressive and formulate better marketing strategies in order to increase sales of high added-value hardwood products rather than low added-value products such as logs. The research team knows that most likely the furniture production will not come back to the U.S. but at least U.S. hardwood producers could use the outputs of this project to offer higher value-added products to their customers in Asia and Western Europe.

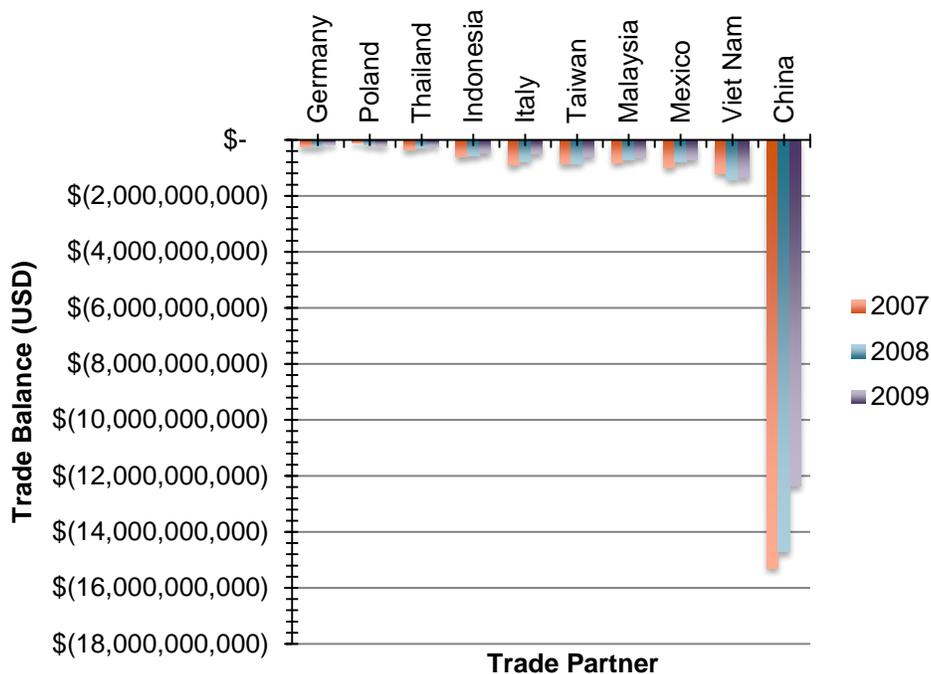


Figure 1.6. U.S. trade balance with global partners of furniture (NAICS 337). (USCB 2010)

It is expected that the outputs of this project will benefit and contribute to the economic development of those regions highly dependent on the hardwood industry. The hardwood industry in the U.S. has a long tradition of sustainability and quality. Hardwood producers need to explore more of these strengths to continue their business growth and international markets present the perfect opportunity.

2 Objectives

2.1 General Objective

The purpose of this research is to identify opportunities to increase the *export performance* of U.S. hardwood firms in Asia and Europe. This study will build upon previous research by incorporating the revision of commonly accepted *export performance* factors, but will also contribute to the international marketing body of knowledge by exploring the competitive advantage delivered by product-service characteristics (which are derived from the value chain model), alongside the effect of cultural and political characteristics of the markets, in Asia and Europe, and thus, address the research needs established in the problem statement (**Error! Reference source not found.**).

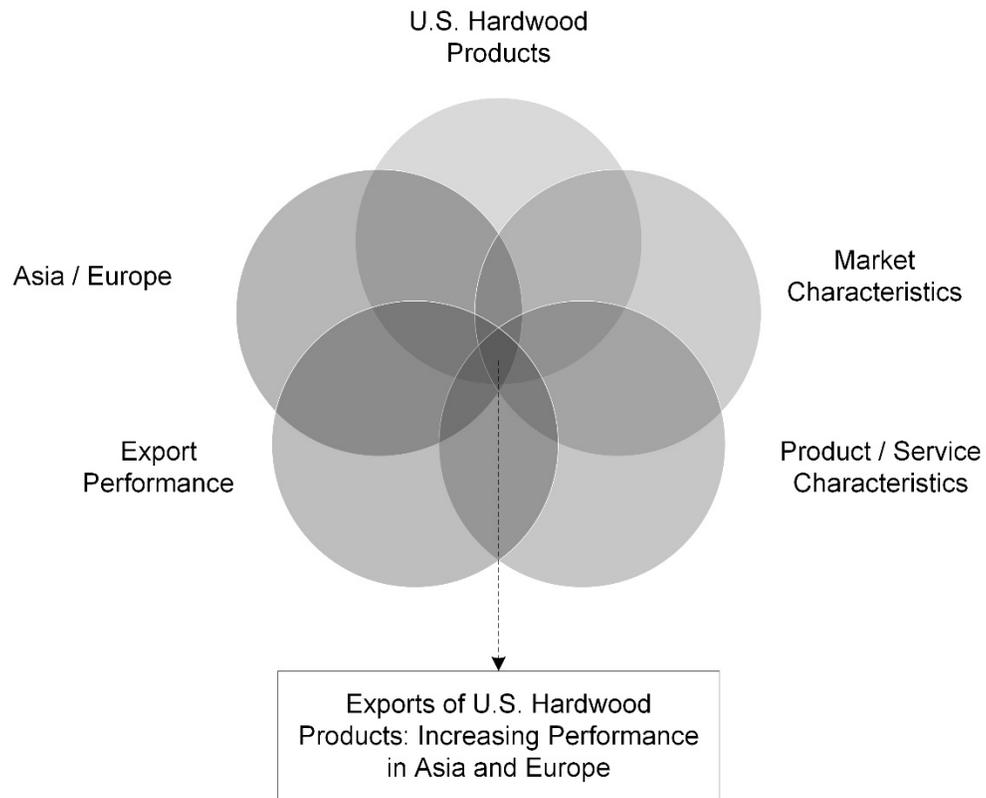


Figure 2.1. Research Project Focus Areas

2.2 Specific Objectives

2.2.1 Phase I

- Identify of the relevant aspects of products and services delivered by U.S. hardwood firms, from the importer's perspective
- Classify the relevant characteristics based on the *order winner / order qualifier* framework for customers in Asia
- Classify the relevant characteristics based on the *order winner / order qualifier* framework for customers in Europe

2.2.2 Phase II

- Investigate the U.S. hardwood firms' attitudes and strategies to export to Asian and Western European markets

- Design and distribute a survey to evaluate U.S. hardwood sawmills attitudes and strategies towards exports to Asia and Western Europe and
- Analyze survey data using univariate and multivariate statistical methods
- Establish the relationship between the market environment and *export performance* in U.S. hardwood exporting firms.

2.2.3 Phase II

- Develop a quantitative model, to explain the behavior of pricing, one of the most important product-service characteristic, as determined in phases one and two
- Carry out a case study in two U.S. hardwood exporting firms to adapt and test the model

Determine the availability of secondary data sources to compare the behavior of selected variable, both at the firms' and market level.

3 Study Design (Methodology)

3.1 Overall approach

This research project consisted of three main phases, each one intended to address the specific objectives presented in section 2 (Figure 3.1). In phase I, an exploratory study was carried out to understand the importance of *export performance* factors found in the literature, and assess the need of incorporating new ones in a model specifically adapted for the U.S. Hardwood Industry. For this purpose, importing firms were interviewed in trade fairs Asia and Europe, and the data analyzed using categorical data methods.

In phase II, the research team surveyed a sample of U.S. hardwood firms that, as of January 2014, maintain export operations in Asia, Europe or both. The results of phase I were used to design a questionnaire, which measured the importance of the factors identified both in the literature and the previous sections. It consisted of six main sections: section one included the variables corresponding to the characteristic of the responding firm. Section two covered the explanatory variables of the *export performance* model for the Asian markets, and section three accounted for those of the European markets. Section four encompassed the response variable of this model for both geographic regions. The survey was conducted on-line, within the first quarter of 2014, and the sampling framework was based on the directory of the National Hardwood Lumber Association (NHLA).

As it is discussed in detail in the next sections, the studies conducted in phases one and two, confirmed that pricing remains as one of the key aspects of the product, in connection with *export performance*. For this reason, a case study was conducted in phase III to explore the pricing and revenue management processes in two U.S. hardwood exporting firms, in order to assess the benefit of implementing alternative optimization strategies. The first part of the study

involved a set interviews with the firms’ sales and marketing management representatives, which helped the researchers improve their understanding of their pricing-related processes within each company, along with the characteristics of the product lines or configuration (i.e. combinations of species, grade, thickness and cut type). In the second part, the researchers conducted correlation and regression testing, to determine the relationship between price and demand for each product configuration. Finally, Monte Carlo simulation was utilized to assess the relative benefit of the proposed pricing policies, in comparison with the companies’ current pricing methodology

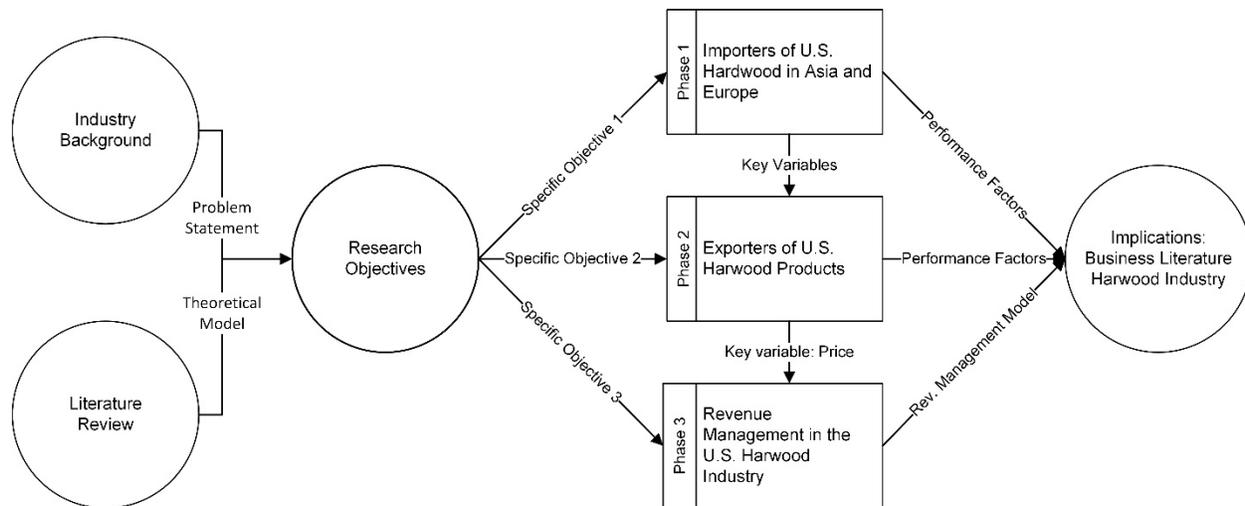


Figure 3.1 Overview of Study Design (Methodology)

3.2 Phase I

The objective of the first phase of this project, which sets the scope of this publication, is to capture customers’ opinions about the key aspects of the products and services delivered by hardwood firms through value chain activities. For this purpose, a comparative case study (Dul and Hak 2008) was implemented between January 2013 and October 2013 to explore the drivers of competitiveness and performance in international markets of hardwood products. Similar studies have been implemented in the past to determine the export opportunities for hardwoods products in Central America (Lyon 2011), Mexico, Asia, and Europe (Parhizkar *et al.* 2010); however what sets this study apart is the introduction of order qualifiers and winners, as a mean to understand the impact scope of competitiveness drivers. The study sample consisted of a set of furniture and interior finishing firms, which were interviewed following a semi-structured questionnaire. To select the companies, the research team attended a series of trade fairs in Asia and Western Europe for suppliers to the furniture and interior finishing industries, where importers of hardwood products were identified as potential respondents. Three trade fairs were visited in the following order:

- Interzum trade fair for suppliers to the furniture industry and interior finishing in Cologne, Germany; attended in May 2013
- The 14th International Furniture Fair in Chengdu (IFF), China; attended in July 2013

- The 11th Vietnam International Woodworking Industry Fair (VIWIF) in Ho Chi Minh City, Vietnam; attended in October 2013.

The choice of trade fairs was based on the importance of the respective geographic regions for the U.S. hardwood export business. Considering the exploratory nature of this study, and the feasibility of doing strict probability sampling on the mentioned regions, the respondent companies were selected through a non-probability sampling methodology (Babbie 2010). Haphazard sampling, the sampling technique used by the research team, is a valid research technique for exploratory studies, in particular for pretesting the adequacy of survey items to properly operationalize concepts (Bernard 1995). An initial set of wood-based product manufacturers were selected among the exhibitors of the cited trade fairs. Interviews with company representatives were carried out once it was determined that imported hardwood lumber was among their main raw materials. Altogether, the questionnaire was designed to explore the factors that may have an impact on the performance and competitiveness of hardwood suppliers. The first six items of the questionnaire refer to the characteristics of the responding firm, its suppliers, and wood products imported from the latter. In question seven, the respondents were asked to mention their basic expectations from their hardwood suppliers' products and services. These expectations were conceptualized as "order qualifiers" (Hofmann *et al.* 2013) to represent the characteristics that a supplier must demonstrate for a customer to consider establishing a business relationship. Question eight in turn addressed those order qualifiers in which respondents believed their expectations have not been fully met in the past. Finally, question nine explores "order winners", those characteristics of the product or service that motivates a customer to choose one supplier rather than one of its competitors (Hill 2000).

In this study, categorical data analyses (Agresti 2002) were conducted to explore the behavior of each variable individually and in association with others. Single variable studies were performed by counting the number of observations per category, and calculating proportions with respect to the sample to infer the respective probabilities (Agresti 2007). When multiple variables were analyzed simultaneously, multidimensional contingency tables were designed, where each variable corresponded with one dimension (Fienberg 2007). The cells of such tables represent the combinations between variables, and the counts within these constitute the basis for the analysis of probabilities. To study the potential relationships between variables in a contingency table, the most widely test used is the Chi-squared test of independence, which validly has been accepted for cells with large numbers of observations (Fisher 1922). When the sample size is small, exact small-sample distributions are more adequate, such as Fisher's exact test (Agresti 2002).

3.3 Phase II

A survey took place between January and May 2014, to assess the importance of *export performance* factors found both in the International Marketing literature and the hardwood business literature. For this purpose, the researchers designed an on-line questionnaire consisting of 7 main sections: "General Information", "General Characteristics of the Company", "Exporting to Asia", "Exporting to Europe", "Marketing in Asia" and "Marketing in Europe". *General information* consisted of only 1 question: "Does your company export hardwood lumber?" This question was used to filter respondents in exporters and non-exporters, and to

allow the latter skip export-related questions. In *General Characteristics of the Company*, the respondents were asked to provide basic information about the firm and its performance: location, number of employees, number of facilities (e.g. sawmills), domestic sales, among others. *Exporting to Asia* addressed the characteristics of markets located in East and Southeast Asia, such as: the distribution of exports per country, preferences regarding hardwood species and product types. Similarly, *Export to Europe* covered the demographics and business strategies in this region. In *Marketing to Asia and Europe*, respondents were also inquired about general aspects of their firms' marketing strategies in Asia, and the factors they believed were key in achieving a better positioning on the same such as product or services characteristics, as well as cultural, social or regulatory aspects of the target market, etc. Finally, in *Export performance*, respondents were asked questions about their firm's financial performance.

The questionnaire was designed, pre-tested and implemented following the "Tailored Design Method" proposed by Dillman et al. (Dillman, Smyth, & Christian, 2009). The selection of the distribution platform was based on aspects such as reliability, security, flexibility and availability to the Virginia Tech research community. The research team opted to use the research software suite provided by *Qualtrics*®. A questionnaire consisting in 35 questions was designed to address the three main areas previously described, which included open-ended and closed-ended questions, most of them categorical. The distribution of the same took place through the National Hardwood Lumber Association's (NHLA) electronic newsletter, in three separate issues: one initial request, and two subsequent reminders. The final reminder was published on the issue of April 15th. Categorical data analyses (Agresti, 2002) were conducted to explore the behavior of each individual variables and the potential relationships among them. These included contingency tables, Chi-Squared tests for independence of one-way and two-way tables, and Fisher's Exact Test of independence of two-way tables.

3.4 Phase III

A comparative case study was designed and implemented to assess the benefit of implementing basic revenue optimization principles in the U.S. hardwood lumber industry. Two hardwood lumber firms constituted the basis for the comparative case study, which will remain undisclosed given the confidentiality of the information provided, and will be referenced as companies A and B. The first phase of the study involved a set interviews with the firms' sales and marketing management representatives, which helped the researchers improve their understanding of their pricing-related processes within each company, along with the characteristics of the product lines or configuration (i.e. combinations of species, grade, thickness and cut type). Once the stakeholders agreed on the product families to be included in the study, a study of historical sales orders was conducted to model the relationship between customer demand, product pricing and contribution. The data analysis was carried out in 2 levels, first, each product configuration was compared with the respective market price. Here, the research team studied potential correlations between the firm's data and that provided by the Hardwood Market Report (HMR), for the period extending from 2009 to 2014. In the second level of the data analysis, the researchers conducted correlation and regression tests to determine the relationship between

price and demand for each product configuration. Those products that presented strong negative linear correlations in their demand-price functions were included in the next step of study, where the total contribution m was modeled as a function of the price as well. Once a definitive set of m curves was established, mathematical programming was used to find the price level in which each is maximized, and therefore served as a baseline for the firm's pricing policies. Finally, Monte Carlo simulation was utilized to assess the relative benefit of the proposed pricing policies, in comparison with the companies' current pricing methodology.

4 Project contributions to the public or private agency partners

The uniqueness of this study consists of addressing a void in the international business body of knowledge: the study of export performance in the U.S. hardwood business, in particular, its relationship with demand management systems and practices. The results provided by this study add new knowledge and empirical data to the discipline which may serve as a basis for future research.

The project has generated practical strategic marketing guidelines to increase the exports of U.S. hardwood products to Asian and Western European countries. It is expected that the outputs of this project will help U.S. hardwood industries in Virginia and in the rest of the country to increase exports of primary hardwood products. The outputs include a detailed analysis of social and cultural aspects related to the wood products industry, current importing practices, a value chain analysis of their production processes, and detailed profiling of the customer by country of analysis. The research team expects that more than 1,000 hardwood industries in Virginia and another 4,000 in the U.S. will read the report and benefit from it. The main outcomes of this project are:

- Increased awareness of international marketing opportunities
- Increased knowledge of customer behavior in international markets of hardwood products

5 Results and outputs

5.1 Phase I

5.1.1 Sample demographics

A total of 38 companies were included in the sample: fourteen from Interzum, ten from IFF, and fourteen from VIWIF. Respondents answered a set of nine questions distributed in two main areas: firm's characteristics and hardwood product imports. Out of the 38 interviewed, 31 companies imported any form of hardwood products. The rest of the companies either acquired hardwood products from domestic suppliers or did not use hardwood species as part of their materials. The distribution of responses by data collection source is depicted in Table 5.1. Most of the responses come from companies interviewed at Interzum: 39 % of sample. Companies interviewed at IFF corresponded to the second biggest sampling group in size: 32%, and the remaining 29 % of responses were collected in VIWIF. Approximately 48 % of the responses

were provided by sales representatives, 16% by procurement employees, 10% of the answers came from marketing personnel and 12.91% from production managers, executives or business owners (12.90% of respondents preferred not to disclose their positions).

The majority of companies interviewed have their main production facilities located in East Asia (39 %): 35% in China and 6% in Taiwan (Figure 5.1). The second major group in size corresponds to firms located in Europe (32%), which includes Germany with 16% and France, Italy and Holland with 6, 6 and 2% respectively. The remaining 29 % of firms was distributed in Southeast Asia (10 %), Middle East (6%), North America (6 %) and South America (3%).

Table 5.1 Distribution of Respondents by Trade Fair Location

Trade Fair Location	Frequency	Proportion
China (IFF)	10	32
Germany (Interzum)	12	39
Vietnam (VIWIF)	9	29

5.1.2 Supplier origin

When asked about the location of their firms’ main suppliers, respondents indicated that in 48% of the cases, hardwood products are sourced from the United States (Figure 5.2). China accounts for 19 % of responses, Thailand for 13 %, Vietnam for 3 % and the remaining 13 % of cases correspond to other countries. The following item in the questionnaire asked for the three top species imported by interviewed firms. In 28% of the responses, a variety of oak was accounted as the main hardwood species traded; followed by ash and walnut with 11% of responses each. Table 5.2 depicts the distribution of imported hardwood species (see bottom row of table).

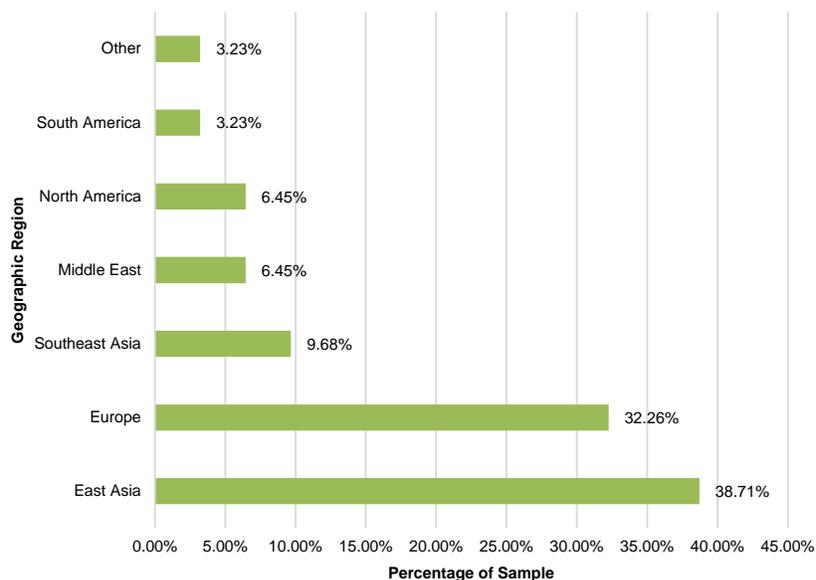


Figure 5.1 Distribution of Respondents by Geographic Region

In order to corroborate any potential relationship between the species traded and the geographic locations of either the interviewed firms or their suppliers, contingency tables and independence tests were performed for the analysis of categorical variables. Statistical independence was tested with Pearson Chi-Squared and Fisher’s Exact Tests, the latter was necessary given the small size of certain combination of variables. First, the researchers were interested in studying the relation between the traded species and the location of respondents’ firms. With a p-value of 0.1006, Fisher’s Exact Test rejected the null hypothesis that species are independent of where respondents are located, with a significance level (alpha) of 0.05. In other words, it appears that each geographic region showed similar preferences for hardwood species. Next, independence of traded species was tested against the geographic location of suppliers. As was expected, a p-value of 0.0005 obtained also with Fisher’s Exact Test, which indicates that the varieties of hardwood commercially traded are dependent on the supplier’s location, also with a significance level of 0.05 (Table 5.2).

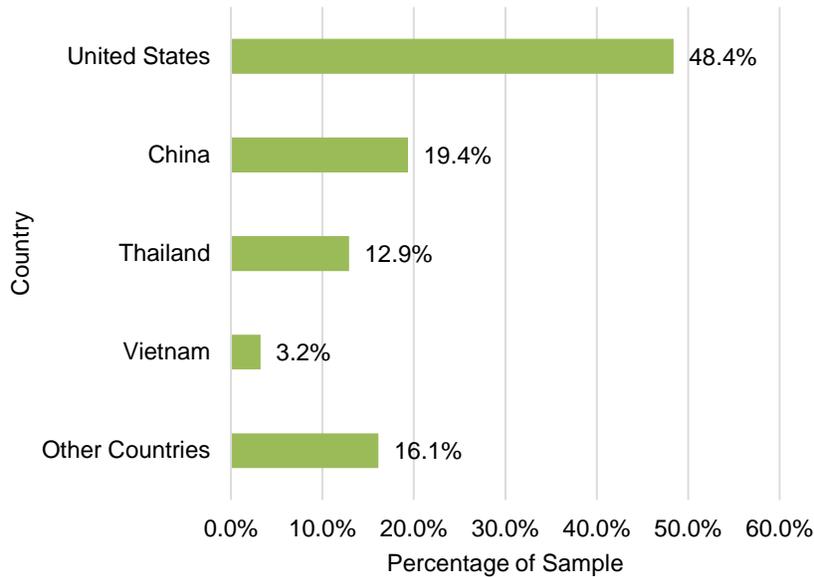


Figure 5.2 Distribution of Hardwood Suppliers by Country

Table 5.2 Distribution of top hardwood species imported from major provider countries (%)

Supplier	Hardwood Species										
	Oak	Others	Ash	Walnut	Maple	Alder	Cherry	Poplar	Rubber Wood	Beech	Total
U.S.	17.1	8.5	4.9	8.5	4.9	4.9	2.4	1.2	0.0	0.0	52.4
China	4.9	7.3	1.2	0.0	1.2	0.0	2.4	2.4	0.0	0.0	19.5
Others	4.9	0.0	2.4	2.4	0.0	0.0	0.0	0.0	0.0	2.4	12.2

Thailand	1.2	0.0	2.4	0.0	0.0	0.0	0.0	0.0	4.9	0.0	8.5
Africa	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7
Vietnam	0.0	2.4	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	3.7
Total	28.1	22.0	11.0	11.0	6.1	4.9	4.9	4.9	4.9	2.4	100.0

5.1.3 Imported hardwood species

Following the question about hardwood species, the respondents were then asked to indicate the main hardwood products imported by their respective firms. Lumber occupied the first place in importance with a 38% of answers; followed by logs, veneer and dimension lumber with 19%, 15% and 15% respectively. Flooring and other products accounted for 11% of responses. Here the researchers were also interested in studying the level of association between hardwood products and the geographic locations of both importing firms and their suppliers. A Fisher's exact test was performed for *hardwood products* as the response (dependent) variable, and *respondent's location* as the explanatory (independent) variable, for both *country* and *geographic region* levels. With a significance level of 0.05, the test *respondent geographic Region* versus *hardwood product* resulted in a p-value of 0.5058, and 0.6090 for the comparison of the latter against *respondent country*. Therefore, no significant statistical evidence was available to reject the null hypotheses, which stated that the proportion of hardwood products consumed by responding firms, changed from one location to another. In other words, it seems that the different regions (or countries) in the sample show similar buying patterns. In contrast, when applying Fisher's test to *hardwood product* as the response (dependent) variable, and *supplier location* as the explanatory (independent) variable, the obtained p-value of 0.0228 indicates that the null hypothesis was rejected with a significance level of 0.05, and therefore there is indication that sourcing of hardwood products changes depending on the supplying country.

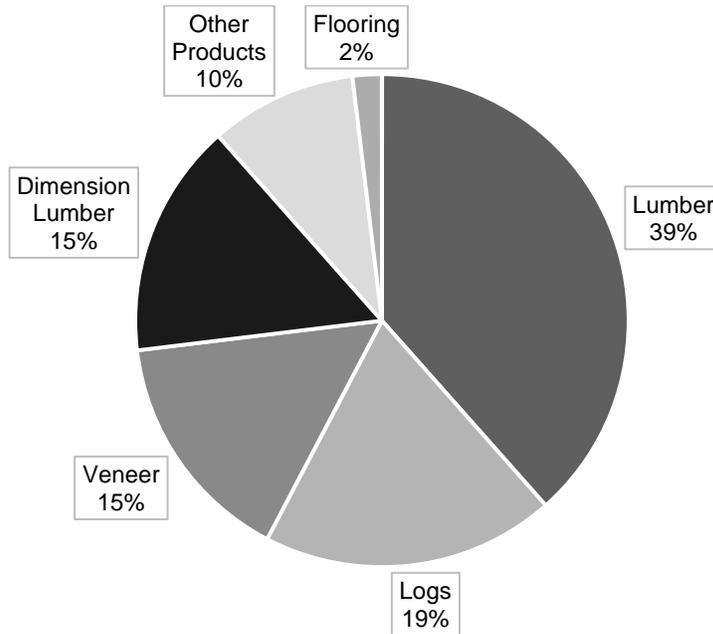


Figure 5.3 Hardwood products imported by interviewed firms

5.1.4 Sought characteristics in partners

Questions previously discussed (1 to 6) referred to the characteristics of the firm and their procurement practices. In the following questions, respondents were asked about aspects they value the most at the time of choosing trade partners (hardwood suppliers in particular), the obstacles and problems they have faced in the past with their suppliers, and opportunities for these to offer additional value. In question 7, respondents were asked about the factors of concern to their firms in the selection of the main hardwood supplier, which, for the purpose of this study, were named *order qualifiers*. Their answers to this open-end question were first coded into *order qualifiers* and then grouped in three main categories: *product characteristics*, *service characteristics*, *firm (supplier) characteristics* and *others*; according to the concepts of export performance studied in the literature review. A total of 18 individual *order qualifiers* were coded by researchers, which are depicted in Figure 5.4. The category of *product characteristics* corresponded to 65% of the responses obtained, whereas *service characteristics*, *firm characteristics* and *others* accounted for 28, 5 and 1 % respectively. *Price* and *quality* stood out as the qualifiers with higher frequency counts -25 % each, followed by *color*, *customer service* and *species availability* with 9%, 8% and 6% respectively. The remaining 25% consisted of 6 qualifiers, mostly within the *service characteristics*.

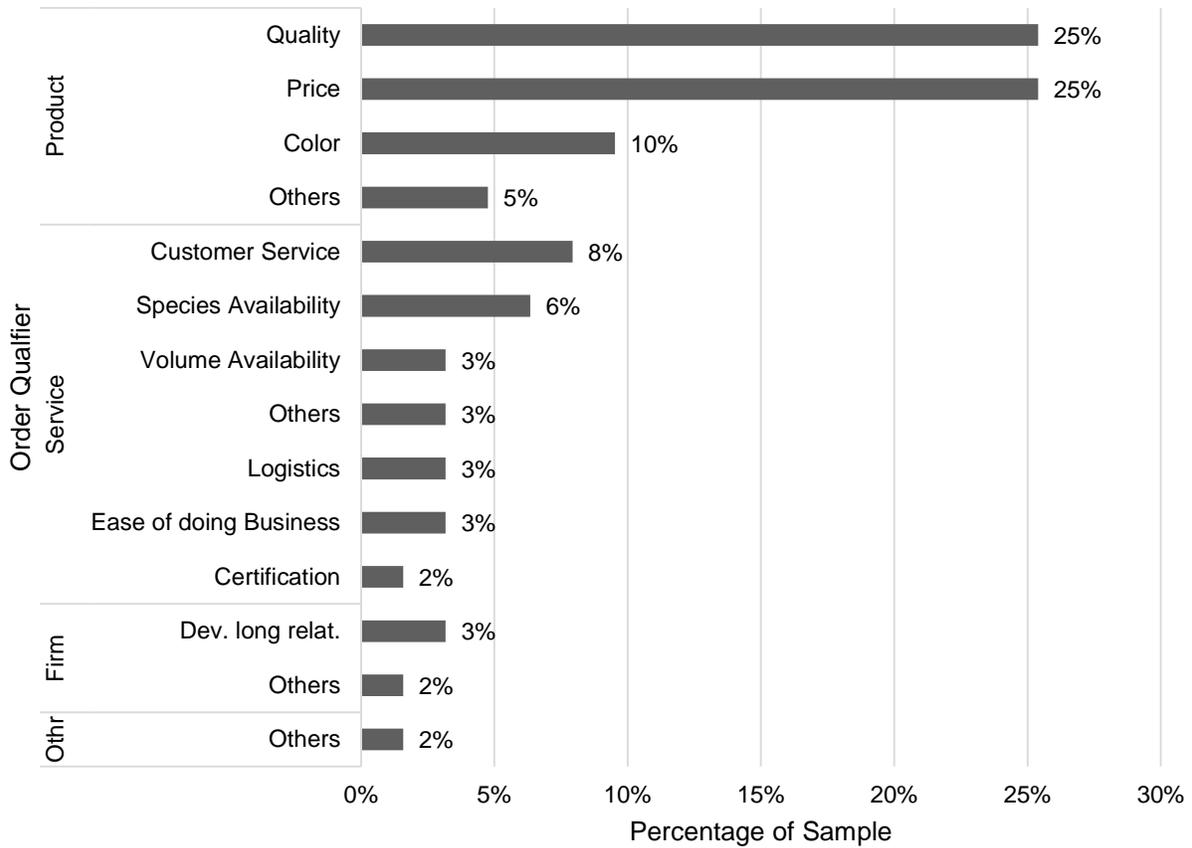


Figure 5.4 Question 7: Order Qualifiers

A Fisher's exact test was conducted to examine the relationship between the three *order qualifier* categories (*product*, *service*, *firm* and *others*) established in question 7, and the respondent's location. With a p-value of 0.3584, the researchers failed to reject the null hypothesis, which stated that proportions of above factor categories remain the same for all geographic regions. This means that the distribution of factor categories depicted in Figure 5.4 is independent from the regions considered in this study. Similarly, the Fisher's test conducted for *order qualifiers* as the response variable, and the *supplier country* as the explanatory variable, resulted in a p-value of 0.6874 with a significance level of 0.05. Therefore, there was not sufficient statistical evidence to reject the null hypothesis, which was that the distribution of *order qualifier* categories remains the same between suppliers (locations).

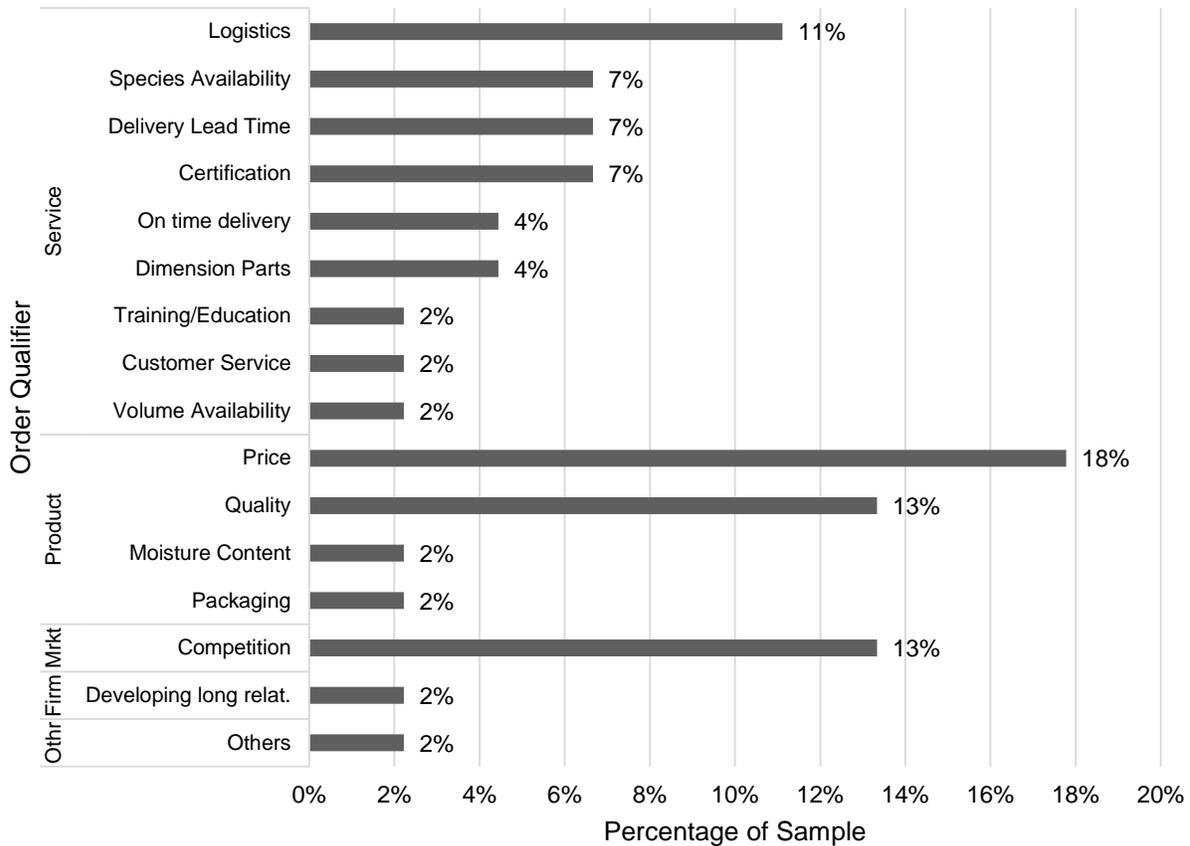


Figure 5.5 Question 8: Order Qualifiers

5.1.5 Relationship of sought characteristics

The researchers also examined the nature of the relationship between the *order qualifiers*, in comparison with the hardwood species and types of products (e.g. lumber, logs) imported. The Chi-squared test for *hardwood species* versus *order qualifier categories* resulted in a p-value of 0.2741, and the test conducted for *hardwood species* versus individual *order qualifiers* in a p-value of 0.9140. With a significance level of 0.05, the researchers failed to reject the null hypothesis, since there is not statistical evidence to demonstrate that the proportions of *order qualifiers* or *order qualifier categories* change from species to species. In other words, the *order qualifiers*, and their respective categories are independent from the *hardwood species*. For the test conducted between *product types*, *order qualifier categories* and individual *order qualifiers*, the researchers obtained p-values of 0.6951 and 0.7875, which indicated that the type of product has no significant effect on the qualifiers in general.

In question 8, respondents were asked to mention barriers or roadblocks they have faced in their business relationships with suppliers of hardwood products. Just as in the previous question, the barriers and roadblocks proposed by respondents correspond to features of the product supplied, the service, or the characteristics of the supplier. Given the similarities between the response items of this and the preceding question, the research team also coded the former as *order qualifiers* and *order qualifier categories* with the distinction, however, that the latter

corresponded to aspects of the supplier, its products or services, where customer's expectations have not been fully met

Figure 5.5 depicts the distribution of responses obtained in question 8. A total of 21 *order qualifiers* were observed in this question, which were classified in four main categories: *service characteristics*, *product characteristics*, *market characteristics*, *firm characteristics* and *others*, whose corresponding distribution of sample responses were 47%, 35%, 13%, 2% and 2% respectively. In contrast with results obtained in the preceding questions, in which product-related *order qualifiers* accounted for the majority of responses, it is observed that, from the respondents' perspective, hardwood suppliers failed to meet their expectations in service-related *order qualifiers* more frequently.

Table 5.3 Question 8: Independence Tests

Independent Variable	Dependent Variable			
	Order Qualifier Category		Order Qualifier	
	Chi-Squared Test	Fisher's Exact Test	Chi-Squared Test	Fisher's Exact Test
	P-Value	P-Value	P-Value	P-Value
Respondent's Country	0.5781	0.3291	0.7961	0.8949
Respondent's Region	0.3924	0.3844	0.2739	0.3390
Supplier's Country	0.1112	0.0410	0.4442	0.2900
Product Species	0.3564		0.7758	
Product Types	0.9911	0.9831	0.7028	0.7875

The top 5 *order qualifiers* in frequency counts of responses were: *price* with 18 % and *competition* with 13%, followed by *quality*, *logistics*, and *certification*, which were 13%, 11% and 7% respectively. These 5 items accounted for 62% of all responses, 3 of which corresponded to price characteristics, 1 to service characteristics, and 1 to market characteristics. Another aspect that should be mentioned is the presence of *market* as a new *order qualifier* category, which was not observed in question 7. Further discussion of the meaning of this category will be provided in the next sections. Table 5.3 summarizes the results of tests conducted to study the independence of the order qualifiers as dependent variables, versus the respondent's location, supplier's location, hardwood species and types of products traded. In almost all cases, there was a failure to reject the null hypotheses with a significance level of 0.05 which signaled the absence of associations between the qualifiers and the mentioned explanatory variables.

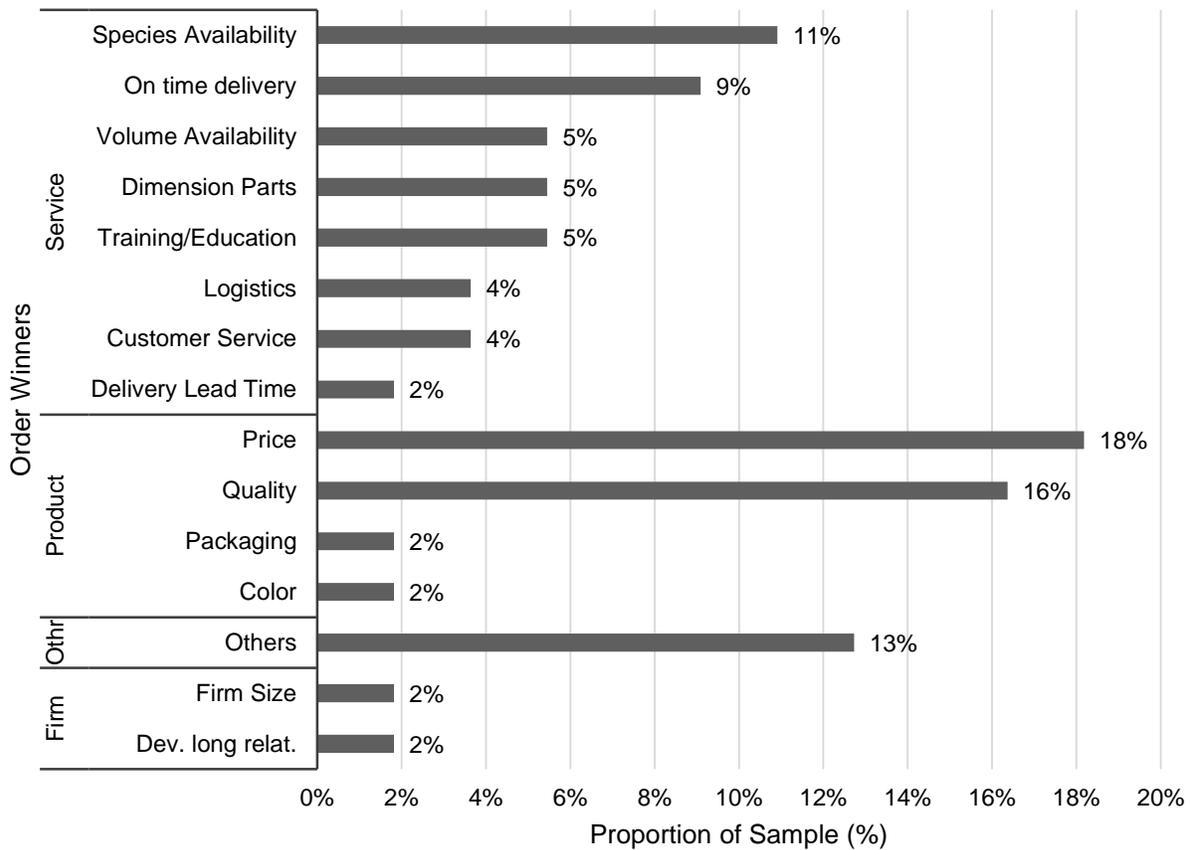


Figure 5.6 Question 9: Order Winners

5.1.6 Importance of supplier characteristics

The last question of the survey was intended to measure *order winners*, rather than *order qualifiers*. In contrast to the latter, *order winners* are those characteristics of the product, service, etc. that offer additional value to the customer, and therefore may help companies achieve better positioning than the competition. The answers provided by respondents were coded into 20 order winners, which were categorized in: *service characteristics*, *product characteristics*, *firm characteristics*, and *others*. Similar to the results observed in question 8, and in contrast with the same of question 7; most of the *order winners* fall within the category of *service characteristics*, hence their importance to adding new value to customers. These *order winners* accounted for 45% of responses, followed by product-related *order winners* with 38, *supplier characteristics* with 4%, and *others* with 13% of all responses. The top 5 individual order winners were: *price*, *quality*, *species availability*, and *on-time delivery*; which accounted for 18%, 16%, 13%, 11% and 9% of responses respectively. A complete list of *order winners* per category is presented in Figure 5.6.

Independence tests were conducted in question 9 for the same combination of variables studied in the two preceding questions. Table 5.4 depicts the results obtained in each test. The p-values obtained in this round of analyses also indicated the absence of any association between those

aspects believed to add value to customers, and some of the characteristics of the customers themselves, their products and suppliers.

Table 5.4 Question 9: Independence Tests

Independent Variable	Dependent Variable			
	Order Winner Category		Order Winner	
	Chi-Squared Test	Fisher's Exact Test	Chi-Squared Test	Fisher's Exact Test
	P-Value	P-Value	P-Value	P-Value
Respondent's Country	0.9068	0.9575	0.9957	0.9849
Respondent's Region	0.9576	0.9884	0.9983	0.9997
Supplier's Country	0.4385	0.5851	0.0067	0.4314
Product Species	0.9772	TBD	0.7807	TBD
Product Types	0.9944	0.9923	0.9898	TBD

5.1.7 Conclusions and Lessons Learned for Objective 1

Exports haven't come to raise the industry's total production levels to match 1999 records (14 BBF), but they have certainly become a key market for short and long term growth (HMR, 2012). Firms need to have a good understanding of the characteristics and dynamics of markets to formulate proper strategies to increase growth and improve profits. Even though there has been extensive research on export performance, this field of study of International Business, is still characterized by fragmentation, diversity and inconsistency in results.

Studying the determinants of exports performance has been one of the major priorities in the field since the 1970s. Conversely, despite of the tremendous attention devoted by researchers, a comprehensive theory that explains export performance is yet to be developed. Moreover, there has been abundant research on export performance, but not on the hardwood industry. For the sample selected in this case study, the characteristics of the hardwood importing firms, their procurement practices, the aspects they value the most at the time of choosing trade partners (hardwood suppliers in particular), the obstacles and problems they have faced in the past with their suppliers, and opportunities for the these to offer additional value, have been analyzed.

Four main dimensions have been found to have a potential impact on export performance: characteristics of the Product, Service, Market and Firm (supplier). These categories together consist in a total of twenty-one factors, which have been divided into order qualifiers and winners. The *order qualifiers*, are the characteristics that customers perceive as necessary for a potential supplier to be considered for doing business. The *order winners*, account for those features that improve the supplier's position in the eye of customers, and therefore may lead to improving export performance. It has been found that product-related order winners (i.e. *product*

characteristics) are the foundation for entering the export markets of hardwood products. Factors such as price, quality and color, are fundamental not only to join the competition, but to improve a hardwood firm's competitive advantage. However, any growth strategy should be accompanied by specific actions intended to improve multiple aspects of a firm's service, such as *logistics, species & volume availability, delivery lead time*, among others.

Given the exploratory nature of this case study, it is important to emphasize the need of additional research to examine the potential relationships between the factors

5.2 Objective 2: Investigate U.S. hardwood sawmills attitudes and strategies to export to Asian and Western European markets

5.2.1 General Characteristics of the Companies

A total of 27 responses were obtained from the members of NHLA, out of which, at least seven observations contribute only with partial information (i.e. incomplete items). Therefore, this analysis and its conclusions described the characteristic and interactions of export performance factors within the sample, and serve as an exploratory study for the hardwood lumber industry in general, since given the limitations of data availability, further inferential work cannot be performed.

The first item of the survey asks whether the respondent's firm exports hardwood lumber or not. Approximately 85 % of the sample confirmed to be involved in international trade of hardwood lumber, while the remaining 15 % of respondents are not currently exporting. In average, the firms surveyed have been in the lumber industry for almost 45 years, out of which the company with least experience accounted for 11 years, and the oldest for 61 years. The average number of employees found in the sample was 133.5, where the smallest firms consisted of 10 employees, and those bigger in size have a workforce of about 500 employees. At least 2 firms were found not to have any employees dedicated to sales and marketing activities, and approximately 27% of sample has 2 employees in this category. When inquired about the number of sawmills currently in operation, 45% of the sample confirmed to possess only one, while 27% indicated not to be directly involved in lumber production (i.e. distribution, commercialization only), whereas one firm acknowledged to own ten sawmills. The domestic sales for 2012 seem to be mostly distributed between 5 and 40 million USD (Figure 5.7): 87% of responding firms reported within this range, and 12% of the same stated export sales above 50 million USD.

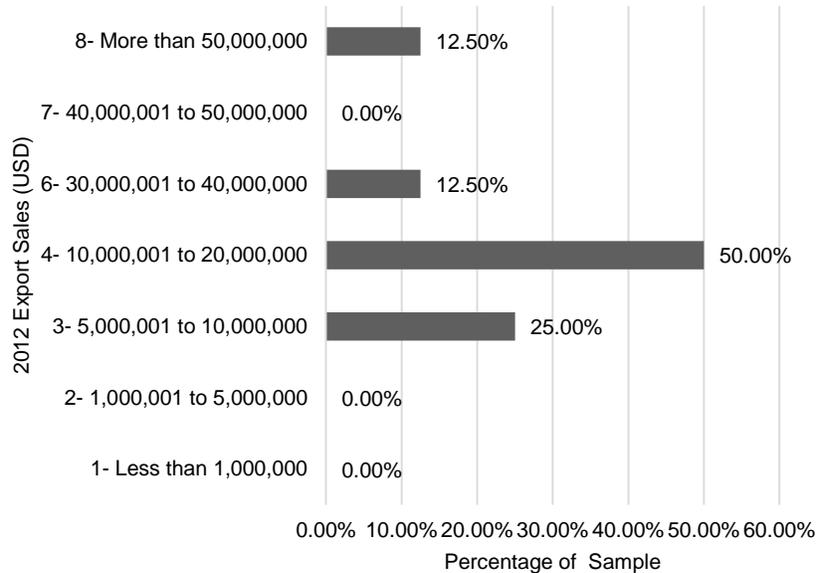


Figure 5.7 Distribution of Respondents by Exports Sales

5.2.2 Exporting to Asia

5.2.2.1 Market Characteristics of Asia.

The sample included in this study consisted of 88% of firms currently exporting to Asia, and 12% of non-exporters. On average, exporting firms have been trading with Asian countries for approximately 24.5 years, whereas the firms with more time in these markets accounted for 64 years, and the new entries for 4 years. Figure 5.8 depicts the approximate distribution of exports per country. China and Vietnam together accounted for 91% of the exports to Asia, whereas Indonesia represented 4 %, and other countries the remaining 5 %. The majority of the U.S. hardwood lumber imported to these countries is consumed by the furniture industry (43%), 27.5% goes to flooring manufacturing firms, and the remaining 30% was distributed among millwork, cabinets, pallets and other sectors. In 32% of the instances, the Asian firms acquired the U.S. hardwood lumber they needed from wholesalers in Asia, whereas in 28% of the times, firms contacted the U.S. suppliers directly, or a wholesaler in the U.S. (24%). It was also found that in 12% of the cases, the lumber is distributed through U.S. firms' own affiliates located in Asia, or other channels (remaining 4%). Finally, it was found that 33% of firms in this study exported red oak, 32% exported yellow poplar, and 20% white oak.

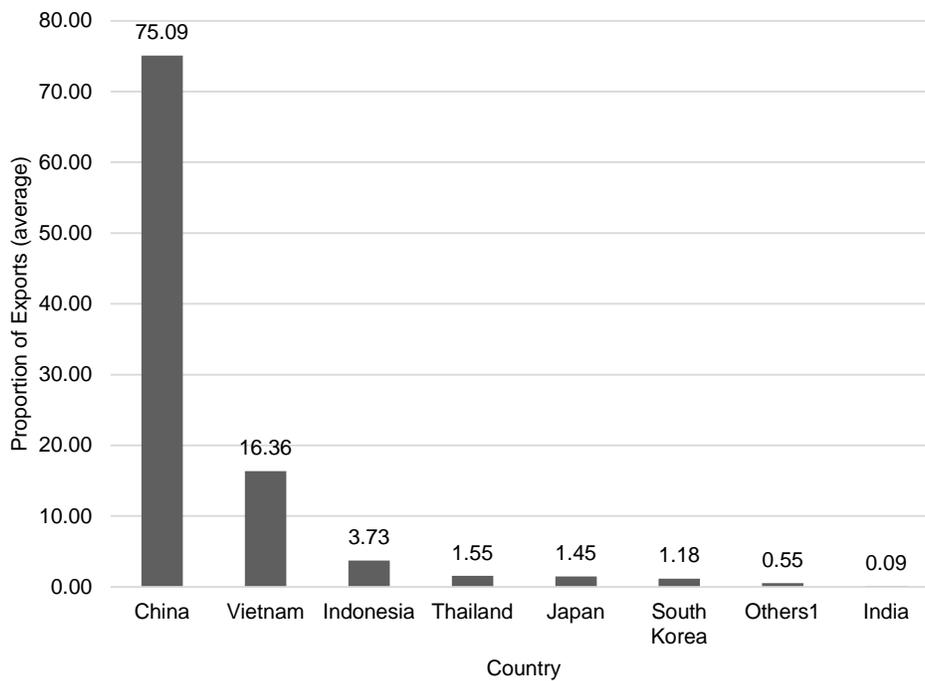


Figure 5.8 Distribution of Exports of U.S. Hardwood Lumber to Asia (averages)

5.2.2.2 Export Strategies to Asia.

Firms involved in this study, were asked about their strategic plans for long term growth and increasing profitability in Asia, as well as the importance of specific tactics to improve competitiveness, market positioning, and hence export performance in this region. Figure 5.9 depicts the relative importance of proposed marketing strategies for growth in Asia. At least 10% of the sample considered that improving their pricing policies was necessary to ensure future growth in this region, whereas 20% believed in introducing new product features, and 30% in increasing promotion and advertisement (P&A). The “others” category, which accounted for 40% of the sample, included strategies such as diversifying the customer base and changing the communication strategy. The strategies intended to increasing profitability in the Asian markets are summarized in Figure 5.10. In contrast to the “*growth strategies*,” *improving prices* was considered by 28% of the sample to be critical for increasing the profitability of exports to Asia. In a similar fashion, 29% of respondents indicated that increasing productivity was their path towards this goal. Other strategies found to be also important were *reducing manufacturing* and *transportation costs* (19 and 14 % respectively). The remaining 10 % of responses include *reducing P&A costs* and *others*.

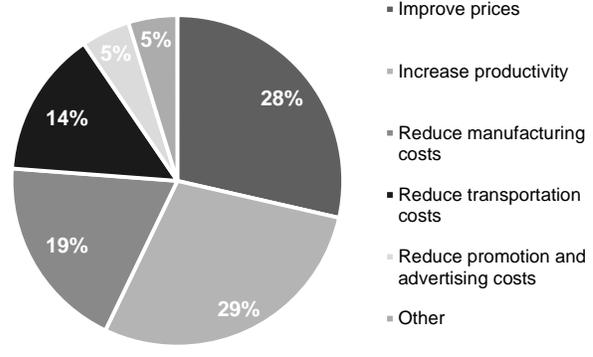
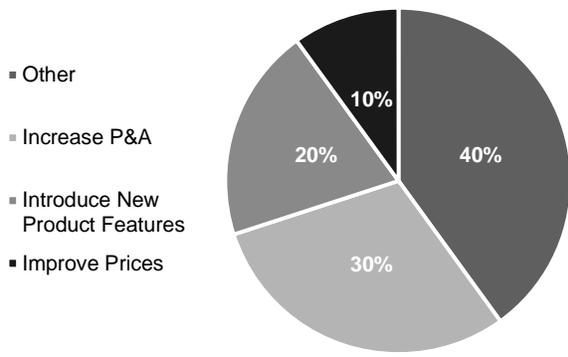


Figure 5.9 Respondent's Plans for Growth in Asia Figure 5.10 Respondent's Plans for Profitability in Asia

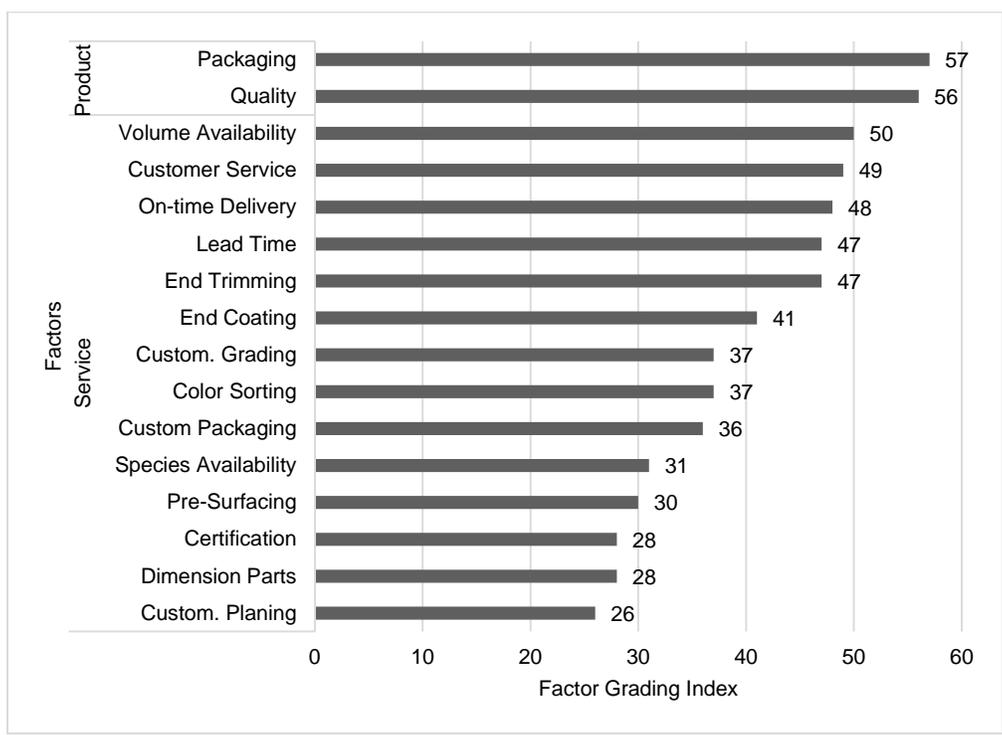


Figure 5.11 Export Performance Factors (Drivers) in Asian Markets

The results of question 11, which measured the relevance of export performance factors found in the literature review for Asian markets, are depicted in Figure 5.11. This measurement was conducted using a Likert scale of 7 points, which is condensed into a 3-point scale for simplicity of reporting. It was intended to quantify the importance of 16 distinct export performance factors in the form of what Hill conceptualized as *order winners* (Hill, 2000). The *order winners* are those characteristics of either the product, service, etc. that offer additional value to the customer, and therefore may help companies achieving better positioning than competition. Thereby question 11 is grouped into two main categories: *product characteristics* and *service*

characteristics, according to the concepts of export performance studied in the literature review. The top 6 individual order winners in Asia were: *Quality, Packaging, Volume Availability* and *Customer Service*. The first 2 were product related, and the other 6 were service related.

The last 2 sets of variables evaluated in this section of the questionnaire addressed social, cultural, political and regulatory characteristics of the export markets themselves. The social and cultural factors' relative distributions are presented in Table 5.5. The 3 top factors found in the "important" category were *Business Ethics, Language* and *Values/Beliefs/Attitudes*, with relative percentages are 15%, 11% and 11% respectively. The respondent firms remained more neutral about factors such as the *Education Level* and *Religion*, (9% and 11% respectively) and did not present any significant percentage in the "Not Important" category of the socio-cultural factors.

Table 5.5 Importance of Socio-cultural Characteristics of Asian Markets Respondent's Export Performance

Factor	1- Not Important	2-Neutral	3- Important	Total
Business ethics	0.00	1.89	15.09	16.98
Customs and traditions	3.77	5.66	7.55	16.98
Education level	0.00	9.43	5.66	15.09
Language	1.89	3.77	11.32	16.98
Religion	3.77	11.32	1.89	16.98
Values, beliefs, attitudes	1.89	3.77	11.32	16.98
Total	11.32	35.85	52.83	100.00

Table 5.6 Importance of Political-Regulatory Characteristics of Asian Markets Respondent's Export Performance

Factor	1- Not Important	2- Neutral	3- Important	Total
Bureaucracy	0.00	3.75	7.50	11.25
Business Protection	0.00	3.75	7.50	11.25
Gov. Foreign Policies	1.25	3.75	6.25	11.25
Gov. Attitude to Foreign Business	0.00	1.25	10.00	11.25
Gov. Controls/protectionism	0.00	1.25	10.00	11.25
International Association	1.25	7.50	2.50	11.25
Political System	1.25	2.50	7.50	11.25
Political stability	0.00	1.25	8.75	10.00
Regulatory System	0.00	2.50	8.75	11.25
Total	3.75	27.50	68.75	100.00

Similarly to socio-cultural factors, respondents did not seem to consider any of the political and regulatory factors unimportant, only 4% of the responses fell within this category. On the other hand, 27% of the respondents remained neutral about the effects these factors may have on export performance. Particularly, *International Association* of export markets, showed a relative percentage of 7 in the *neutral* category. Most of interviewed firms' responses fell in the *important* category. Factors related to foreign government's attitudes and policies towards U.S.

firms led this category with equal percentages of 10 each; followed by *political stability*, *regulatory system*, *bureaucracy* and *business protection*: with 9%, 9%, 8% and 8% respectively. The results of this question are presented in Table 5.6.

5.2.3 Exporting to Europe

5.2.3.1 Market Characteristics of Europe

It was found that 73% of the sample is currently exporting hardwood lumber to European countries. In average, firms have been in this market for around 28 years. It was also determined that the firm with least experience started exporting to Europe 10 years ago, and that with more time in these markets, forty-four years. The biggest market is the United Kingdom (Figure 5.12), which represents 24 % of exports, followed by Spain, Italy and Germany with 23%, 20%, and 19%, respectively. Other markets accounted for 15% of exports. Approximately 38% of the lumber exported by these firms to Europe, is used in the millwork industry, while 29% was used in furniture. Cabinets and flooring accounted for 10% and 6% respectively, and other industries accounted for the remaining 16%.

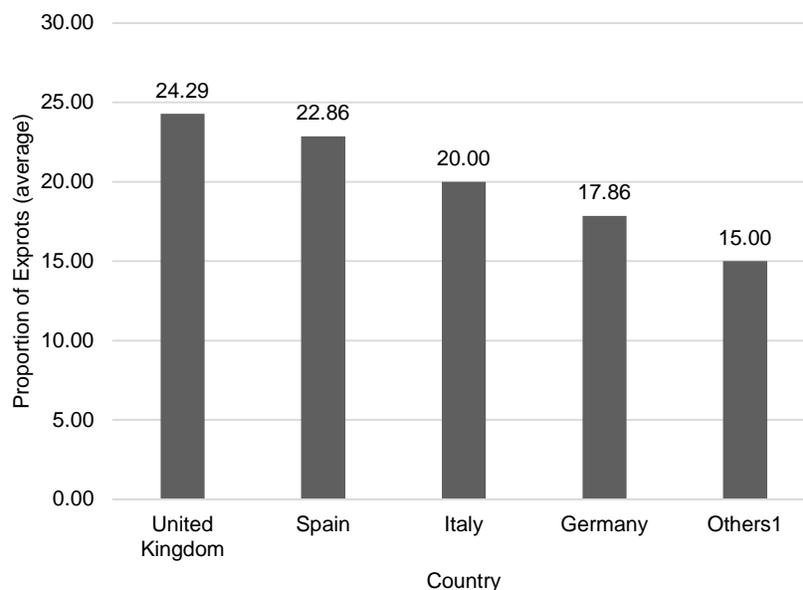


Figure 5.12 Distribution of Exports of U.S. Hardwood Lumber to Europe (averages)

The top 3 hardwood species exported by sampled firms to Europe were: white oak, red oak, and yellow poplar, with proportions of sample of 38%, 29% and 13% respectively. When asked about how European customers bought their products, respondents indicated that in 40% of the cases, orders were directly placed with their U.S. office; whereas export sales made through wholesalers in Europe represented 33% of the sample. Affiliates in Europe manage 20 % of the exports on average; and whereas wholesalers in the U.S., manage 7 %.

5.2.3.2 Export Strategies to Europe

Firms currently exporting to Europe defined their main strategies as ensuring future growth in the area, increasing promotion/advertisement (P & A), introducing new product features,

improving prices, and others (Figure 5.13): *Increasing P & A* strategies appeared in 43% of the responses, while *introducing new product features* in 29 % of instances. Also, the factor *improving prices*, represents the third strategy in importance: 14% of sample; and *others* accounts for the remaining 14%. The three top factors to improve profitability in the European export market are *increase productivity*, *reduce manufacturing costs*, and *improve prices*; which represent 26%, 26% and 21% respectively (Figure 5.14). Factors such as *reduce transportation, promotion, advertisement costs, and others* account for 26% of the sample.

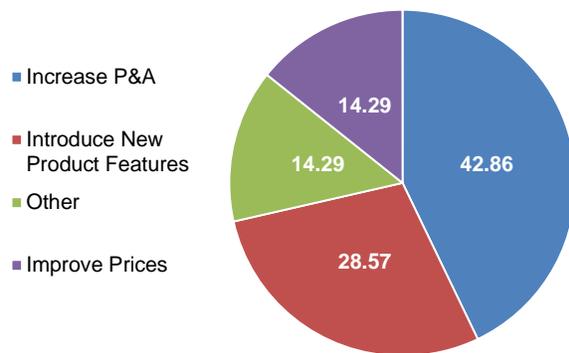


Figure 5.13 Respondent's Plans for Growth in Europe

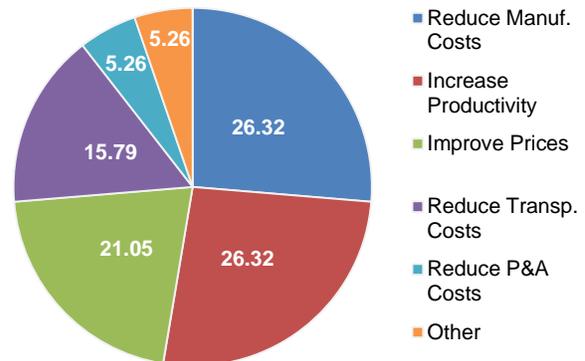


Figure 5.14 Respondent's Plans to Increase Profitability in Europe

This study also assessed the importance of the 16 *order winner* factors commented in section 5.2.2.2. Here respondents indicated the degree of importance that each factor has in adding value to their customers in Europe. Again, this measurement was conducted using a Likert scale of 7 points, which is condensed into a 3-point scale for simplicity of reporting (i.e. 1 –not important, 2 –neutral and 3 –important). As it was also observed for the previous region, those factors directly related to the product *quality* and *packaging* were ranked the highest – 100 % of respondents placed these as *important* (Figure 5.15). These are followed by the service-related order winners: *certified products*, *customer service*, *end-trimming*, and *volume availability*. All of these factors were also regarded as important in 86% of the instances. None of the 16 factors were considered as *not important* or *neutral*.

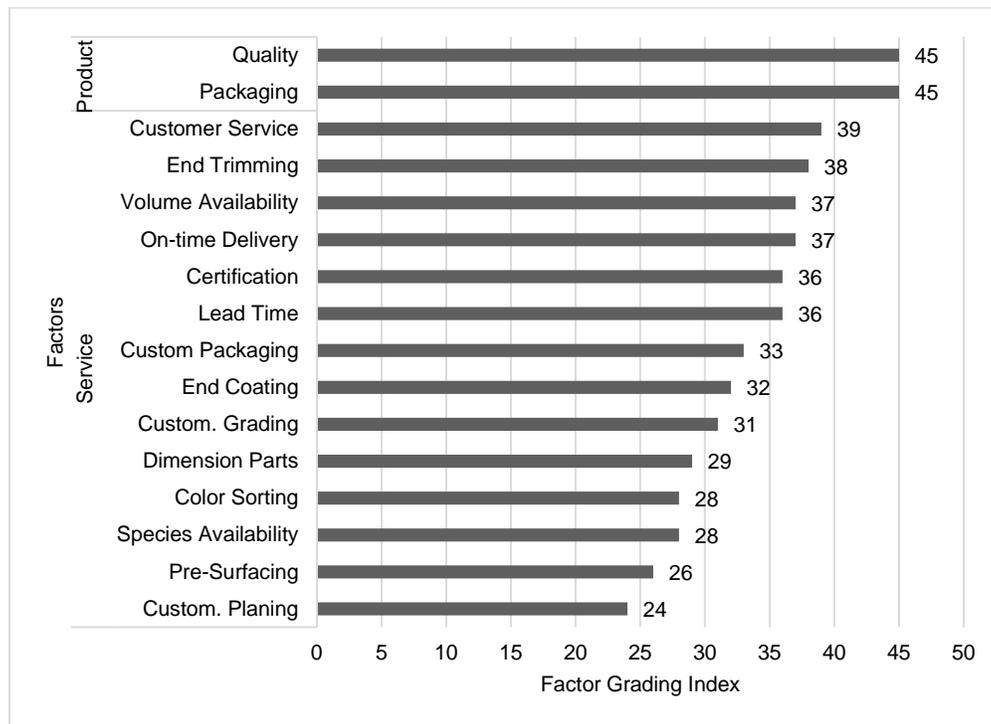


Figure 5.15 Export Performance Factors (Drivers) in European Markets

When studying the socio-cultural characteristics of European markets, and their impacts on export performance, researchers found that the top three factors of importance were *business ethics, customs and traditions* and *values, beliefs and attitudes*; which correspond to 17, 12 and 12 % of the sample respectively (Table 5.7).

Table 5.7 Importance of Socio-cultural Characteristics of European Markets in Respondent's Export Performance

Factor	1- Not Important	2-Neutral	3- Important	Total
Business ethics	0.00	0.00	11.67	16.67
Customs and traditions	2.38	2.38	11.90	16.67
Education level	0.00	9.52	7.14	16.67
Language	2.38	4.76	9.52	16.67
Religion	2.38	11.90	2.38	16.67
Values, beliefs, attitudes	2.38	2.38	11.90	16.67
Total	9.52	30.95	59.52	100.00

Finally, those factors related to the political-regulatory characteristics of European markets and their impact on the responding firms' export performance, are summarized in Table 5.8. In contrast with the previous question, which had responses in the *important* category account for 59% of the sample, here the political-regulatory factors were regarded as important in 84% of the instances, so that answers in the *neutral* and *not important* classifications account for 16% of the

sample. It was also found that 4 factors related to the position adopted by the government of European countries towards U.S. hardwood companies were rated as *important*: attitude towards foreign business, control and protectionism of the local industry, the political system and country's stability.

Table 5.8 Importance of Political-Regulatory Characteristics of European Markets

Factor	1- Not Important	2- Neutral	3- Important	Total
Bureaucracy	0.00	1.59	9.52	11.11
Business Protection	1.59	1.59	7.94	11.11
Gov. Foreign Policies	0.00	3.17	7.94	11.11
Gov. Attitude to Foreign Business	0.00	0.00	11.11	11.11
Gov. Controls/protectionism	0.00	0.00	11.11	11.11
International Association	3.17	3.17	4.76	11.11
Political System	0.00	0.00	11.11	11.11
Political stability	0.00	0.00	11.11	11.11
Regulatory System	0.00	1.59	9.52	11.11
Total	4.76	11.11	84.13	100.00

5.2.4 General Questions about Exports

The last section of the survey addressed 2 general aspects of the export venture. More specifically, respondents were asked to provide their opinion about the value added by distinct institutions in improving their performance. Then, the questionnaire concluded by asking firms about the growth of sales and profit, driven by international markets in 2012. Figure 5.16 depicts the assessment of domestic efforts to help companies improve their performance in international markets. The question consists of a set of 8 items, which were evaluated using a Likert scale of 7 points (categories) for importance. An index was created using the frequency count of responses, and weighted by the Likert categories (1 to 7). According to this assessment, responding firms found the most value to their export ventures in the support provided by trade associations, overseas tradeshows, and the U.S. Department of Agriculture (USDA). The bottom 3 factors corresponded to the support efforts coming from *Foreign Government Agencies*, *University extension programs* and *others*, although it was found that respondents regarded the effect of these programs as neutral, rather than not important. For example, for *University Extension Programs*, 43 % of the sample considered them neutral, whereas the important and not important categories, accounted for 28 % of the sample each.

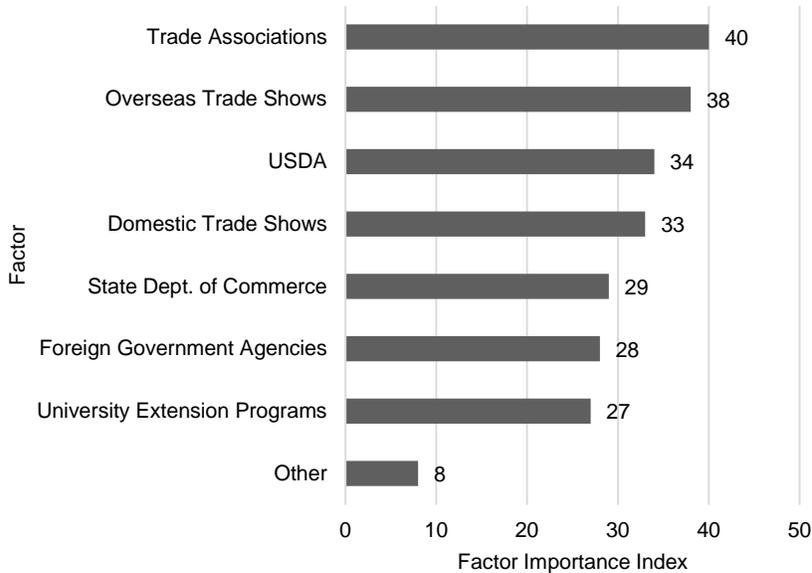


Figure 5.16 Importance of Export Support Efforts

In order to measure the export performance of responding firms, this study included a set of questions addressing financial indicators such as export sales, profits and growth rates for 2012. The average of export sales was presented in section 5.2.1. The focus of the remaining section and following discussion will be the growth of exports throughout 2012. In Figure 5.17 it can be observed that 75 % of firms in the sample experienced an increase in export sales during 2012, in comparison to 2011. More than a third of these firms (37.5 %) achieved an increase in sales within the 11 to 15 % range. The additional portion of the sample which also experienced growth in export sales was equally distributed among the following categories: 1 to 5 %, 16 to 20 %, and more than 26 %; each accounting for 12.5 % of the sample.

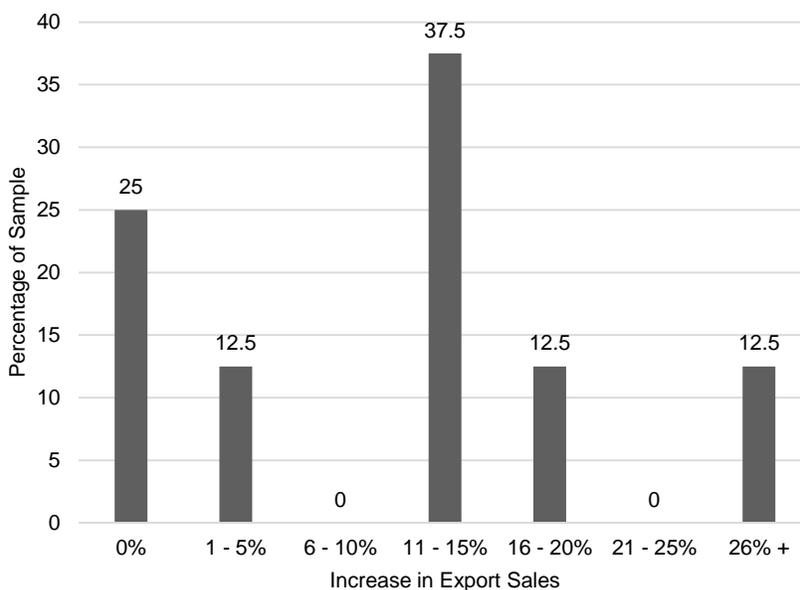


Figure 5.17 Increase in Export Sales of Hardwood Lumber: 2012 vs. 2011

5.2.5 Conclusions and Lessons learned in Objective 2

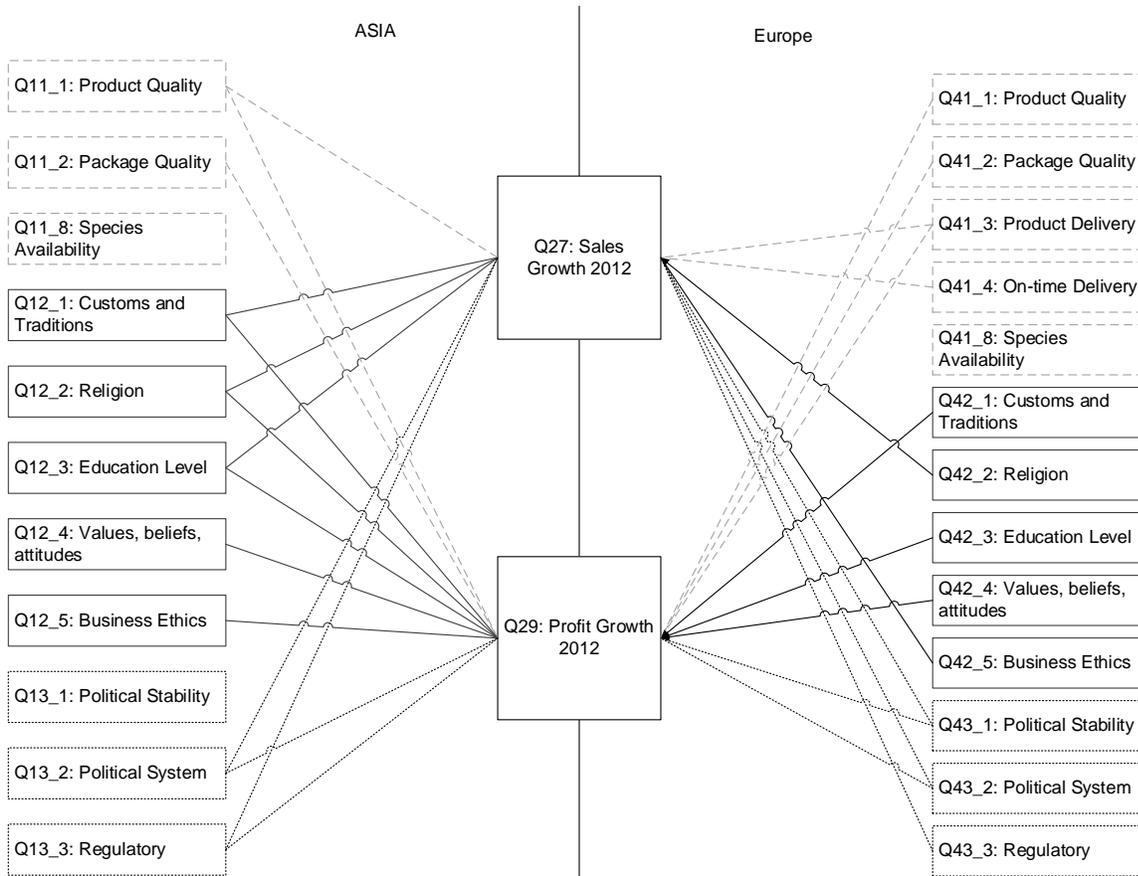


Figure 5.18 Summary of Results Logistic Regression: Asia and Europe

The analysis of the data provided by participating firms indicated that *export performance* can be measured in different forms, is influenced by different variables, and such influence will depend greatly on the market studied and its characteristics (see Figure 5.18). Previous research suggests that business performance depends on how firms utilize their resources to address specific markets' needs. What differentiates one study from the others in the literature is the industry in which the study was conducted, and the variables studied. This study has attempted to comprehend, not one, but multiple dimensions of the *export performance* problem.

A key aspect of the nature of the phenomena studied, which has been confirmed by this research, is that in order to improving export performance, a firm needs to address multiple variables or elements simultaneously. For example, the analysis conducted on the *export performance* metrics related to *sales* or revenue indicates that these were influenced by characteristics of the product and service, the cultural differences in the business relationship, and the political and regulatory characteristics of those firms interested in importing hardwood lumber from the U.S. A similar analysis of the data also led to the same conclusion for profit-related variables.

For the purpose of the practical implementation of above findings, it is important to consider that, out of the 86 variables studied, only 32 (sixteen per geographic region), correspond are characteristics of the product and services offered by hardwood lumber exporters. It is important to recognize that these variables are more easily and directly handled by the firms themselves. Moreover, these variables, typified as *order winners* due to their effect on the competitiveness of the firm, combine all of the marketing strategies and tactics discussed earlier. Therefore, they deserve special attention by those in leadership positions in the industry, trade associations, government and academia. *Price* and *quality* have been and will probably remain the main drivers in business transactions, not only of hardwood lumber, but industrial goods in general. However, what this study has also revealed, is that aspects related to *service*, such as *lead time*, *on-time delivery*, volume and species availability, among others, may have more relevance for improving the performance of U.S. hardwood exporters than other aspects related to the product itself. There have been abundant studies both in the industry and academia on quality of hardwood lumber products, and technologies to make the grading process more efficient. However, the information generated through this research project seems to suggest that improving quality of service may lead firms to improve their positions in the international market.

The identification and understanding of factors impacting international markets for hardwood products in key U.S. overseas markets is essential for U.S. hardwood producers to shape successful marketing strategies. Even though there has been extensive research on export performance, this field of study of International Business is still characterized by fragmentation, diversity and inconsistency in results. The purpose of this research was to identify opportunities to increase the export performance of U.S. hardwood firms in Asia and Western Europe by gathering insights from companies, trades associations, and government agencies about the state of the export business, its main drivers, opportunities for growth and challenges. A total of 27 responses were obtained from the members of NHLA, out of which, at least 7 observations contributed only with partial information, which represented less than 3 % of the total population. Therefore, this analysis and its conclusions describe the characteristic and interactions of export performance factors within the sample, and serve as a case study for the hardwood lumber industry in general, since given the limitations of data availability, further inferential work cannot be performed. This study has confirmed that product quality and price remain as key components of the export strategies in Asia and Europe equally, but also revealed that aspects related to the service such as lead time, on-time delivery, volume and species availability, among others, may have more relevance for improving the performance of U.S. hardwood exporters, than other aspects related to the product itself.

5.3 Objective 3: Identify specific marketing strategies using results from objectives 1 and 2.

5.3.1 Demand Management

In the last six years, yellow poplar has become the third most exported hardwood species from the U.S. in lumber form only after red oak and white oak. This product, which has almost doubled its market participation since 2000 by substituting other species such as maple (*Acer* genus), represented 14% (266.7 million USD) of the total value of U.S. hardwood lumber

exports in 2013, and 20% of the volume (288.1 million BF) for the same year (FAS, 2014). Also in terms of volume, 76% of the exports of U.S. yellow poplar lumber in 2013 were destined to Asia: 40% to East Asia, and 35% to Southeast Asia. The European Union and North America accounted for 13% and 9% of the same, respectively, and other geographic regions for the remaining 2.20 %. In the same context, the top 3 importers of U.S. yellow poplar lumber were China, Vietnam and Mexico: with 36%, 31% and 8% of the total value respectively (FAS, 2014).

Yellow poplar lumber is priced and traded based on the grade, thickness and whether it is green or kiln dried - gross or net tally. Figure 5.19 depicts the market prices of this species for the period between 2012 and 2014. It can be observed that kiln-dried yellow poplar lumber, gross and net tally prices on FAS, 1 Common and 2 Common grades, shows a positive trend throughout this time-frame. Three distinct price levels can be also distinguished, which are derived mainly from the lumber grade and then by whether it is green or kiln-dried. For instance, FAS prices ranged between 1038 and 1113 USD per MBF on gross and net tally respectively, during the second half of 2013. For the same period, the market price for kiln-dried 1 Common remain fixed at 741 USD per MBF on gross tally, while net tally stayed at 796 USD per MBF. Finally, 2 Common yellow poplar lumber traded at 550 USD per MBF gross tally during the second semester of 2013, whereas deals on net tally were made around 591 USD per MBF.

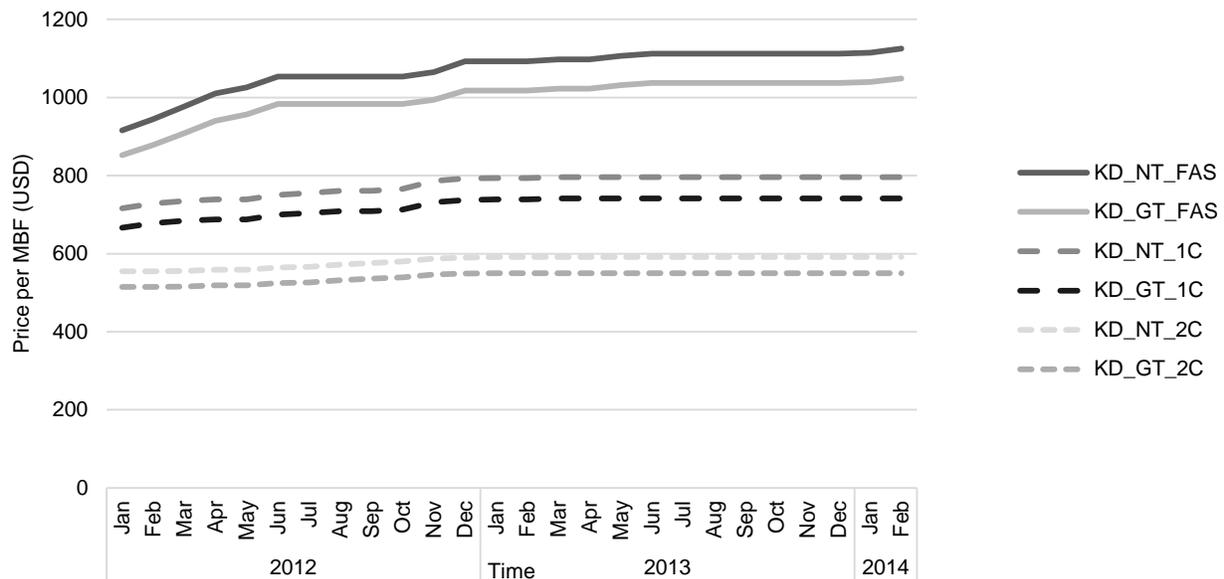


Figure 5.19 2013 Market Prices: Yellow Poplar Lumber

5.3.1.1 Comparison of Firm's Prices versus Market Prices

In order to compare the market gross tally prices of yellow poplar lumber on FAS with those of company B, the researchers conducted one-sided *t*-tests (Fisher, 1925) on the sample means, *F*-tests on the variance and normality on the pricing variable. The results of this analysis, which are depicted in Table 5.9, indicate that there is sufficient statistical evidence to suggest that on average, market prices were higher than company B's throughout 2013. According to the summary of descriptive statistics, the average market price during this year was 1031.1 USD per MBF, whereas that of the firm was 1017.7 USD per MBF. The analysis conducted on *I*

Common revealed that company B's pricing are statistically higher than the market: the average of the former was 811.5 USD per MBF in 2013, whereas the market's mean price was 740.9 USD per MBF. Similarly for 2 *Common*, the study indicates that Company B's 2013 prices, whose average was 654.20, were higher than those of the market, being its average 550.00 USD per MBF.

Table 5.9 Tests for means and variances: Market vs. Company B

Parameter	Test	Method	DF	Statistic Value	<i>p</i> -value
Mean	t-test	Equal Variance (Pooled)	325.00	-20.17	<.0001
Mean	t-test	Unequal Variance (Satterthwaite)	137.71	-16.45	<.0001
Variance	Variance	Folded F	203.00	9.46	<.0001

5.3.1.2 Demand versus Price Curve

As it was indicated previously, company B is currently exporting white oak lumber in four different grades, seven thicknesses and only one type of cut which translates into twenty-eight products. In the same fashion as company A, an exploratory data analysis was conducted to identify the products that meet the criteria described earlier. As it has been depicted in Table 5.10, it was found that only 1 product met the requirements to proceed with the pricing modeling whereas 15 products were discarded due to the absence of negative linear correlation, and the other 12 products were disregarded due to missing data above 50%.

Table 5.10 Correlation Analysis of Price vs. Demand: Company B

Product	Cut Type	Tally	Grade	Thickness	Pearson's Coefficient	<i>p</i> -value
B01	1	Gross	FAS	6/4	-.6464	.0064
B02	1	Gross	FAS	4/4	-.1810	.3300
B03	1	Gross	FAS	5/4	-.1670	.4050
B04	1	Gross	FAS	7/4	.9300	.0220
B05	1	Gross	FAS	8/4	.0270	.8440
B06	1	Gross	FAS	10/4	.3680	.2960
B07	1	Gross	FAS	12/4	-.6040	.0850
B08	1	Gross	1C	4/4	.5020	.0400
B09	1	Gross	1C	5/4	.4940	.0370
B10	1	Gross	1C	6/4	.5940	.002
B11	1	Gross	1C	7/4	.3050	.802
B12	1	Gross	1C	8/4	.6710	.001
B13	1	Gross	2C	4/4	.6070	.002
B14	1	Gross	2C	5/4	.6530	< .001
B15	1	Gross	2C	6/4	.4290	.029
B16	1	Gross	2C	8/4	.5140	.004

It is important to highlight that the product that met the criteria previously exposed in the literature review (code named as product B1), only did so for a subset of the data. The original dataset utilized of the exploratory data analysis of product B1, consisted in 36 sales orders, occurred in 2013. Pearson's correlation coefficient of this dataset indicated the absence of a

strong negative linear relation between price and demand; however, a graphical analysis revealed the existence of a bimodal distribution for the demand, which was considered to partition the original data into 2 sets corresponding to "small orders" and "big orders." The limit between these two was set at 13251 BF –the mean of the demand in the original set of observations, causing the resulting Pearson's coefficient of -73.995 to prove being statistically significant with a p -value of 0.002 and α of 0.05. The results of the linear regression analysis corresponding to product B1 are depicted in Table 5.11, whereby it is found that the *price-response* curve is:

$$\text{Product B1: } d_{B1} = 35597 - 29.126 * p_{B1} \quad (5-1)$$

Table 5.11 Simple Linear Regression Product B1: ANOVA Table

Source of Error	DF	Sum of Squares	Mean Squares	F-Value	p-value
Model	1	69949476	69949476	10.05	0.007
Error	13	97442213	6960158		
Total	14	167391689			

For this equation, the resulting coefficient of determination r -square, which is the portion of error explain by the model, amounts to 41.8%, indicating that the model needs to be improved by either incorporating additional variables or exploring other modes of regression. For the purpose of this study, the linear model was used to explore the opportunities for optimization.

5.3.1.3 Pricing Optimization

According to the historic data provided for this study, the average cost for product B1 amounts to 670 USD per MBF. After including this value alongside the price-response curve, in the total contribution function (5-2) the following model is obtained which being partially differentiated on p and equaled to zero, leads to an optimal price p^* of 951 USD per MBF.

$$\text{Product B1: } m_{B1} = (p_{B1} - 670) * (35597 - 29.126 * p_{B1}) \quad (5-2)$$

5.3.1.4 Verification of results

After obtaining the optimal prices for products A1 and B1, the researchers proceeded to compare them with the prices set by the company through their pricing current method. In this phase of the study, a Monte Carlo simulation was conducted by first determining the probability distributions of the demand for each product, and the same were used to generate demand scenarios for the first quarter of 2014. In each case, the total revenue for this period was estimated according to the pricing policies derived from the optimization model and the current pricing methodology

In the case of Company B, it was determined that 2013 demand follows a normal distribution with mean 6184.000 BF and standard deviation 2934.653, according to the Anderson-Darling test (Anderson & Darling, 1954), whereby the A^2 statistic amounts to 0, .330, which is less than the critical value of 0.752, corresponding to a level of significance than 0.05. Also, considering the behavior of sales in 2013, it is estimated that the current pricing policy of company B for

product B1 can be represented through a second degree polynomial, as shown in the equation (5-3), given that the mean absolute percentage error (MAPE) amounts only 4.7 %.

$$\text{Product B1: } p_{B1} = 0.8609 + 0.0358t - 0.001819t^2 \quad (5-3)$$

Where:

p = lumber price, in U.S. dollars per thousands of board feet (MBF)

t = time, in months

The Table 5.12 depicts the simulated demand and pricing policies. The average of optimized prices given by the model is \$ 0.960 and the predicted prices average is \$ 0.861. The standard deviation for the optimized prices is 0.020 and the standard deviation for the predicted prices is 0.071. This suggests that the deviation of the predicted prices, that is, those prices predicted by the company's current polices, is greater than the deviation of optimized prices where the observed values are closer to the average and a more homogeneous distribution is given.

Table 5.12 Monte Carlo Simulation: Summary of Results, Company B

Month	Year	Simulated	Pricing Methodology			
		Demand (BF)	Current		Proposed	
			Price (USD)	Margin (USD)	Price (USD)	Margin (USD)
January	2014	10867.05	0.929	0.251	0.951	0.273
February	2014	6089.30	0.865	0.188	0.945	0.267
March	2014	5105.10	0.788	0.110	0.983	0.305

The contribution margin obtained from the optimal price and the predicted price are also shown in Table 5.12. According to the validation strategy of this study, it appears that revenue margins derived from the set of optimized prices are higher than those expected from Company B's current methodology, throughout the simulated scenario.

5.3.2 Conclusions and Lessons Learned of Objective 3.

Characteristics of U.S. Hardwood Lumber Demand

The data analysis conducted in phases 1 and 2 of this study, revealed that a significant portion of the cases had upward slopes in their respective P - R curves. The majority of products with significant linear correlation show positive values for the Pearson's or Spearman's coefficients. The economic theory (Black, Hashimzade, & Myles, 2012) indicates that the level of demand for a good or service is inversely proportional to its price. And even though the early developments in consumer theory have supported the notion that consumers' income and the substitution effect favor increased consumption when the price rises (Lancaster, 1966), later studies on the topic suggest that at the aggregate level and under certain conditions, the law of demand will hold (Hildenbrand, 1983; Lancaster, 1966).

It was previously affirmed in the literature review that the demand curves (i.e. *price-response* curves) considered for this study are supplier-specific, and that different suppliers may show different demand curves. Implicitly, conditions prevailing at the firm level may also result in demand characterized by upward slopes.

The exploratory data analysis performed in this study served as a basis to demonstrate that in some cases, it is possible to extract "portions" of the demand in which the downward slope assumption was held. These sub-datasets were determined by studying gaps in the distributions of the price and demand separately, and through the consideration of other variables such as customer location. Generally, most of the data segmentation was possible for those products whose demand variables proved to show multimodal patterns, or outliers.

It is important to clarify that this case study research contemplated only those instances in which a strong-nonnegative-linear dependence between price and demand was observed. Other instances for which such assumption was not met may comply with the requisites, and be subject to other classes of regression analysis (e.g. nonlinear, parametric). In other words, this "*linearity filter*," is a device implemented only to limit the sample size of this case study, which by definition needed to be small.

Pricing Optimization: Impact on the Firm's Revenue

The prices obtained through the optimization procedure proved to be significantly lower than those from participating firm A. It is interesting to observe that the variations in the historical prices of the cases studied in this firm, were in general small. For instance, product A1 has a coefficient of variation of 2.83 %, a standard deviation of 0.0023 USD, and a range of 0.309 BF, on its price. This condition served to indicate that this product's demand was not strongly sensitive to changes in prices. The price elasticity e , which is obtained by dividing the proportional change in the demand by the proportional change in price, was estimated for the mean and extreme price points observed in product A1. As it can be observed in Table 5.13, product A1 is significantly elastic, and such condition augments with the price. From this perspective, pricing decisions for this product need to be carefully evaluated and planned, which seems to explain the low variability in historic prices. Therefore, it appears that products with such slow changes in pricing may not be good candidates for revenue optimization.

Table 5.13 Price-point Elasticities: Product A1

Point	Price	Elasticity (e)
Mean	1541.01	39.8228
Median	1540.90	39.7176
Maximum	1560.00	79.2022
Minimum	1486.30	15.9196

Company B on the other hand, showed that it was beneficial to implement pricing optimization for product B1. According to the simulating design, the equation used to forecast the firm's pricing decisions for the first quarter of 2014, predicted that same would continue with the negative trend that was observed in the last quarter of 2013, whereas the optimization model reacted faster to the changes in the simulated demand, kept prices at higher level and therefore led to higher revenue margins than the current methodology.

The purpose of this research project was to explore the principles of revenue management (RM) and its application to the revenue and pricing decisions in the U.S. hardwood lumber industry. Two hardwood lumber firms constituted the basis for the comparative case study. Both companies are located in the Appalachian region, and trade their products in domestic and international markets.

In this study, historic sales data were analyzed in order to determine optimum pricing values for multiple products in each company. The price-demand relation observed in the majority of these products did not fit the requirements for the modeling process, partially because the project focused on products with linear relationships. Therefore there is an opportunity for further studies in demand characterization for the hardwood industry.

The optimization process itself presented mixed results which should serve as an indication that not all hardwood products and markets may be suitable for this approach. Further research is recommended not only for product traded internationally, but for domestic transactions too, which will serve the sales and marketing groups in negotiating pricing with customers with customers. Another aspect that will need to be considered in further research is the inclusion of constraints (e.g. lumber supply, capacity, etc.), to develop more realistic models.

5.4 Objective 4: Marketing Guidelines to understand what economic, social, regulatory, and cultural aspects drive exports of hardwood products to Asia and Western Europe

Exports haven't come to raise the industry's total production levels to match 1999 records (14 billion board feet or BBF), but they have certainly become a key market for short and long-term growth (HMR, 2012). Firms need to have a good understanding of the characteristics and dynamics of markets to formulate proper strategies to increase growth and improve profits. Even though there has been extensive research on export performance, this field of study of International Business, still characterizes by fragmentation, diversity and inconsistency in

results. The goal of this research is to identify opportunities to increase the export performance of U.S. hardwood firms in Asia and Western Europe.

Studying the determinants of exports performance has been one of the major priorities in the field since the 1970s. Conversely, despite of the tremendous attention devoted by researchers, a comprehensive theory that explains export performance is yet to be developed. Moreover, there has been abundant research on export performance, but not on the hardwood industry. For the sample selected in this case study, the characteristics of the hardwood importing firms, their procurement practices, the aspects they value the most at the time of choosing trade partners (hardwood suppliers in particular), the obstacles and problems they have faced in the past with their suppliers, and opportunities for the these to offer additional value, have been analyzed.

5.4.1 From the customer's perspective

From the customer's perspective, four main factors have been found to have a potential impact on export performance: characteristics of the Product, Service, Market and Firm (supplier). These categories together consist in a total of twenty-one variables, which have been divided into order qualifiers and winners. The *order qualifiers*, are the characteristics that customers perceive as necessary for a potential supplier to be considered for doing business. The *order winners*, account for those features that improve the supplier's position in the eye of customers, and therefore may lead to improving export performance. It has been found that product-related order winners (i.e. *product characteristics*) are the foundation for entering the export markets of hardwood products. Factors such as price, quality and color, are fundamental not only to join the competition, but to improve a hardwood firm's competitive advantage. However, any growth strategy should be accompanied by specific actions intended to improve multiple aspects of a firm's service, such as *logistics, species & volume availability, delivery lead time*, among others.

5.4.2 From the perspective of the U.S. hardwood lumber firm.

A total of twenty-seven responses were obtained from the members of NHLA, out of which, at least seven observations contribute only with partial information. Which represents less than 3 % of the total population. Therefore, this analysis and its conclusions are intended to describe the characteristic and interactions of export performance factors within the sample, and serve as a case study for the hardwood lumber industry in general, since given the limitations of data availability, further inferential work cannot be performed. This study has confirmed that product quality and price remain as key components of the export strategies in Asia and Europe equally, but also revealed that, aspects related to the service, such as lead time, on-time delivery, volume and species availability, among others, may have more relevance on improving the performance of U.S. hardwood exporters, that other aspects related to the product itself.

5.4.3 Opportunities on the Price Management Arena

In this study, historic sales data were analyzed in order to determine optimum pricing values for multiple products in each participating company. The price-demand relation, observed in the majority of these products, did not fit the requirements for the modeling process. Partially

because the project focused on products with linear relationships. Therefore there is an opportunity for further studies in demand characterization for the hardwood industry.

The Optimization process itself presented mixed results, which should serve as an indication that not all hardwood products and markets may be suitable for this approach. Further research is recommended not only for product traded internationally, but for domestic transactions too, which will serve the sales and marketing groups in negotiating pricing with customers with customers. Another aspect that will need to be considered in further research, is the inclusion of constraints (e.g. lumber supply, capacity, etc.), to develop more realistic models

5.5 Practical Applications of Results

The results discussed in the previous chapters and section provide a notion on the business areas that need to be addressed by hardwood exporters, in order to increase the value to the customer and shareholders. Figure 5.20 depicts some of the critical value added factors discussed throughout this document, and offers a perspective on the practical application of the same.

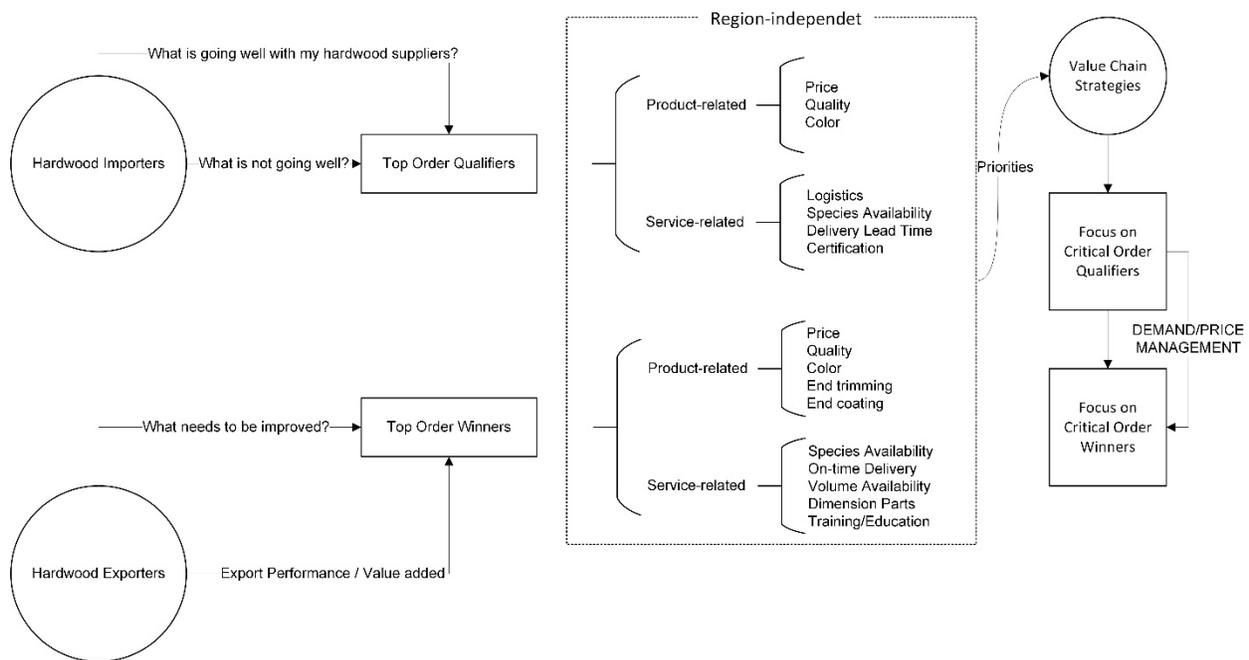


Figure 5.20 Value chain strategies

Offer Competitive Prices: the results of chapter two indicate that price remains as a key factor in both entering a market, and obtaining competitive advance. Exporting firms should look for reliable sources of following information: market prices and price sensitivity. Knowing a company's relative position in terms of market price is helpful to determine if the firm needs to focus on improving it, or address other issues instead. The price sensitivity is useful in determining how sensitive demand to variations in price is. Even though this study suggests that

pricing is a competitive factor in all markets, how sensitive are customers to prices may vary from one region to another. In order to adapt the pricing optimization approach discussed in chapter four, the firm in cooperation with the research team needs to complete a series of steps. First, *study the demand*: companies need to determine if price is a good predictor of the future demand, so that revenue and total contribution may be maximized. In order to do so, analysis is required, with special attention to strength of the relationship between price and demand (i.e. correlation) and direction (i.e. non-positive slope). If the data meet the requirements previously discussed, then an equation to represent such connection needs to be estimated, and the unit cost incorporated into the model of the total contribution. The next step consists in optimizing the price, which should serve as a baseline for the sales representatives in their negotiations with customers during the next sales planning cycle (e.g. week, month). Finally, once the cycle comes to an end, the latest sales data needs to be incorporated in the model. If it follows the same behavior observed in the previous, then the models or equations are still valid, if not, they need to be re-estimated.

Color - level set standards with competition: this attribute was found to be third in importance, after quality and price, in the order qualifiers category. Interestingly, it was found at the bottom list of order winners. The interpretation provide by authors is that markets have a basic set of expectations on color from suppliers. In other words, hardwood firms should meet those expectations to be able to compete, but it may not be a decision factor.

Improve customer service. As it was discussed previously in this study, there is a general trend in U.S. sawmills to deal directly with customers, rather than involving third-parties. For this reason, firms need to learn the key aspects of customer service, valued by Asian and European purchasers. Some of the comments observed in the case study indicate that there is a concern among customers regarding shipment tracking, exports-import paperwork, and attention to customer requests. If a firm is interesting in developing stronger relationships in export markets, then it is important to allocate resources to training and talking to customers about what is important to them.

Optimize Species Availability. Improving the mix of species in stock appears to be one of the key attributes to improve firm's relative position in the market. Regardless of the location of respondent, species availability seems to also one of the areas in which suppliers are failing to meet customer expectations. One of the respondents indicated its frustration when its orders were canceled due to lack of inventory. Firms need to be careful on how they manage their product allocation, and make sure such decisions are based on accurate data.

5.6 Measurable results of the project

The export strategic marketing guidelines generated in this project are expected to help U.S. hardwood industries in Virginia and in the rest of the country to increase exports of primary hardwood products. The project's outcomes are based on the following indicators:

- Increase in the volume of exports of higher value-added products compared to hardwood logs
- Increase in employment opportunities by increasing the processing of higher value-added products
- Increase of the awareness of international marketing opportunities
- Increase the knowledge on customer behavior in international markets of hardwood products

Given that the project has just been completed and the outputs have not been fully disseminated, the quantification of these indicators cannot be conducted at this time.

5.7 A discussion of current or future benefits to be derived from the project.

The uniqueness of this study consists in addressing a void in the International Business body of knowledge: the study of export performance in the U.S. hardwood business, in particular, its relationship with Demand Management systems and practices. The results provided by this study will permit adding new knowledge and empirical data to the discipline and empirical data that may serve as a basis for future research.

In this study, historic sales data were analyzed in order to determine optimum pricing values for multiple products in each company. The price-demand relation, observed in the majority of these products, did not fit the requirements for the modeling process, partially because the project focused on products with linear relationships. Therefore there is an opportunity for further studies in demand characterization for the hardwood industry.

The Optimization process itself presented mixed results, which should serve as an indication that not all hardwood products and markets may be suitable for this approach. Further research is recommended not only for product traded internationally, but for domestic transactions too, which will serve the sales and marketing groups in negotiating pricing with customers with customers. Another aspect that will need to be considered in further research is the inclusion of constraints (e.g. lumber supply, capacity, etc.), to develop more realistic models.

5.8 Recommendations for future research

This wood industry has suffered a continued decline in part as a consequence of the collapse of the domestic housing market, and the overall economic recession that followed. Despite the efforts of the U.S. government to incentive economic expansion, recovery to previous levels of performance remains slow. From this perspective, it is clear that firms need to innovate their ways of doing business to accelerate growth and expand to new markets. Future research is required to better understand the opportunities to ensure the industry's long term growth by improving its supply chains, in particular those areas that have a direct impact on the service

level including lead-times, on-time delivery, transportations costs, among others; where the tools provided by operations research, managing science and supply chain management serve to improve the industry's competitiveness.

5.9 A description of the project beneficiaries including the number, type and scale of producers, processors, and other businesses.

Once the project's outputs are properly disseminated the research team expects that more than 1,000 hardwood industries in Virginia and another 4,000 in the U.S. will be impacted by the outputs.

5.10 Dissemination of results through workshops, extension, trade, and peer-reviewed publications

5.10.1 Presentations

- Quesada-Pineda, H.J. 2013. Markets for Certified Forest Products. Green Building Systems. Room 317B. Cheatham Hall. Virginia Tech. November 13, 2013. Blacksburg, VA.
- Quesada-Pineda, H.J. 2012. Certified Forest Products. WOOD 3004:Sustainable Nature-based Enterprises (Green Business). College of Natural Resources and Environment, Virginia Tech. Cheatham Hall, Room 317. April 18. Blacksburg, VA.

5.10.2 Workshops

- International Trade and Marketing for Forest Products Industry. Instructor: S
Quesada-Pineda, H.J., Snow, M. Bumgardner,
 - Location: NHLA headquartes. Memphis, TN.
 - Dates: May 6, 2014. Workshop was canceled due to low registration.
- International Trade and Marketing for Forest Products Industry. Instructor: H
E. (co-organizer and presenter), Quesada-Pineda, H.J. (co-organizer and presenter), Cooper, M., Seidl, M., and Klinger, S.
 - Location: Vincennes University. Jasper, IN.
 - Dates: May 28. Attendance: 18.

5.10.3 Extension articles

- Arias, E., Lyon, S., Quesada-Pineda, H.J., and Smith, R. 2013. Exports of U.S. Hardwood Products: Increasing Performance in Asia and Western Europe. Center for Forest Products Business. Newsletter. Fall.

5.10.4 Web publications

- Arias, E. 2014. Pricing optimization and demand management in the U.S. Hardwood Industry. Sustainable Innovation Management. Research Brief. January 28. Available at <http://sim.sbio.vt.edu/?p=2045>. Last access May 2014
- Arias, E. 2013. What is survey research? Sustainable Innovation Management. Research Brief. October 13. Available at <http://sim.sbio.vt.edu/?p=1954> . Last access May 2014
- Arias, E. 2013. Determinants of exports performance. Sustainable Innovation Management. Research Brief. March 27. Available at <http://sim.sbio.vt.edu/?p=1773> . Last access May 2014
- Arias, E. 2012. Origins of Supply Chain Management: First 20 Years of Research. Sustainable Innovation Management. Research Brief. March 21. Available at <http://sim.sbio.vt.edu/?p=903> . Last access May 2014
- Arias, E. 2011. Exports of U.S. Hardwood products. Sustainable Innovation Management. Research Brief. October 22. Available at <http://sim.sbio.vt.edu/?p=831>. Last access May 2014

5.10.5 Conference proceedings

- Arias, E., Quesada-Pineda, H.J. and Smith, R. 2014. Exports of U.S. Hardwood Products: Increasing Performance in Asia and Western Europe. 2014 Society of Wood Science and Technology International Convention. Poster presentation. Zvolen, Slovakia. June 23-27.
- Arias, E., Quesada-Pineda, H.J. and Smith, R. 2014. Factors impacting the export of U.S. hardwoods in Germany, China, and Vietnam. 2014 Society of Wood Science and Technology International Convention. Paper presentation. Zvolen, Slovakia. June 23-27.
- Arias, E., and Quesada-Pineda, H.J. 2013. Exports of U.S. Hardwoods Products: Increasing Performance and Asia and Western Europe. Proceedings of the 2013 Forest Product Society International Convention. Session 3: Marketing, page 31. June 9-11. AT&T Hotel and Conference Center, Austin, TX.
- Arias-Blanco, E., Quesada-Pineda, H.J. and Smith, R. 2012. Factors Impacting the International Value Chain of Hardwood Products: A comparison between Asia and Western Europe. Proceedings of the 66th Forest Product Society International Convention. The Omni Shoreham Hotel, Washington, DC. June 3-5. Poster # 39, page 73.

5.10.6 Planned peer-reviewed articles

- Arias, E., Quesada-Pineda, H.J. and Smith, R. 2014. Pricing management in the U.S. hardwood lumber industry: A comparative case of study. *Forest Products Journal*. To be submitted.
- Arias, E., Quesada-Pineda, H.J. and Smith, R. 2014. Current Strategies of U.S. hardwood products Exporters. *Forest Products Journal*. To be submitted.
- Arias, E., Quesada-Pineda, H.J. and Smith, R. 2014. Factors impacting the importation of U.S. hardwood Products: A case of study in Europe and Asia. *International Journal of Wood Products*. To be submitted.

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U.S. Hardwood Lumber: Increasing Exports in Asia and Western Europe

U.S. Lumber Companies Questionnaire

Much of marketing research related to the trading of hardwood products have focused on economic rather than social, cultural, or regulatory factors and little has been done to understand how these factors impact the value chain of hardwood products.

The main goal of this project is to understand the factors that affect the value chain of lumber products in Asia and Western Europe to increase exports and employment opportunities.

If you would like to obtain a copy of the results, please provide your name and email address at the end of the document.

General Information

1. Does your company export hardwood lumber?

- Yes (*proceed to question 2*)
 No (*proceed to question 32*).

Exporting to Asia

2. Does your company export hardwood lumber to Asia?

- Yes (*proceed to question 3*)
 No (*proceed to question 13*).

3. What year did your company start exporting hardwood lumber to Asia?

Year.

4. What percentage of your company's exports to Asia correspond to the following countries? *Please note that total should equal 100%.*

China	Vietnam	Thailand	Japan	India	Indonesia	South Korea	Others	Total
<input type="text"/> %								

► If other(s), please indicate the names:

5. What percentage of your company's exports to Asia correspond to the following types of companies? *Please note that total should be equal to 100%.*

Flooring	Furniture	Millwork	Cabinet	Pallet	Others	Total
<input type="text"/> %						

► If other(s), please indicate the types of companies:

6. How do Asian customers buy your lumber? *Please select all the alternatives that apply.*

- They contact our U.S. offices directly
 Through our own affiliate located in Asia
 They contact a wholesaler located in Asia
 Through a wholesaler located in the U.S.
 Other. Please indicate:

7. What percentage of your company's exports to Asia correspond to the following hardwood species? *Please note that total should equal 100%.*

Ash	Beech	Basswood	Cherry	Hickory	Maple	Red Oak	Walnut	White Oak	Y. Poplar	Others	Total
<input type="text"/> %											

► If Other(s). Please indicate the species:

12. Please rate the importance of the following political-regulatory characteristics of Asian markets on your company's export performance.

<i>Political-regulatory</i>	Not Important at All	Low Importance	Slightly Important	Neutral	Moderately Important	Very Important	Extremely Important
	1	2	3	4	5	6	7
Political stability	<input type="radio"/>						
Political system/ideology	<input type="radio"/>						
Business/marketing regulatory system	<input type="radio"/>						
Government attitude toward foreign business	<input type="radio"/>						
Government controls/protectionism	<input type="radio"/>						
Bureaucracy	<input type="radio"/>						
Business/intellectual right protection	<input type="radio"/>						
International association/organization membership	<input type="radio"/>						
Government foreign policy	<input type="radio"/>						

Exporting to Europe

13. Does your company export hardwood lumber to Europe?

- Yes (proceed to question 14)
- No (proceed to question 32).

14. What year did your company start exporting hardwood lumber to Europe?

Year

15. What percentage of your company's exports to Europe correspond to the following countries? *The total should be equal to 100%.*

Italy	United Kingdom	Germany	Spain	Others	Total
<input type="text" value="36T"/> %	<input type="text" value="100%"/>				

► If other(s), please indicate the names:

16. What percentage of your company's exports to Europe correspond to the following types of companies? *The Total should be 100%.*

Flooring	Furniture	Millwork	Cabinet	Pallet	Others	Total
<input type="text" value="36T"/> %	<input type="text" value="100%"/>					

► If other(s), please indicate the types of companies:

17. How do European customers buy your lumber? *Please select all the alternatives that apply.*

- They contact our U.S. offices directly
- Through our own affiliate located in Europe
- They contact a wholesaler located in Europe
- Through a wholesaler located in the U.S.
- Other. Please indicate:

18. What percentage of your company's exports to Europe correspond to the following hardwood species? *Total should equal 100%.*

Ash	Beech	Basswood	Cherry	Hickory	Maple	Red Oak	Walnut	White Oak	Y. Poplar	Others	Total
<input type="text" value="36T"/> %	<input type="text" value="100%"/>										

► If Other(s). Please indicate the species:

28. What percentage did your export profit increase in 2012 compared to 2011? *Please select only one alternative.*

- 1-5% 6-10% 11-15% 16-20% 21-25% More than 26 % Profit did not increase in 2012
-

29. How many employees dedicate more than 50% of their time to export sales & marketing activities?

Number of employees.

Additional comments

30. From your perspective, is there any other opportunity in the hardwood industry to add value to customers and increase exports you would like to share with us? *Please feel free to add input in any other areas of the survey as you consider convenient.*

General Characteristics of Company

31. What year was your company established?

Year.

32. How many employees work for your company?

Number of Employees.

33. How many sawmills does your company own in U.S.?

Number of sawmills in U.S.

34. How many employees dedicate more than 50% of their time to domestic sales & marketing activities?

Number of employees.

35. What were your company's domestic sales in 2012? *Please select the range that better approximates your sales in U.S. dollars.*

From	0	1,000,001	5,000,001	10,000,001	20,000,001	30,000,001	40,000,001	50,000,001+
To	1,000,000	5,000,000	10,000,000	20,000,000	30,000,000	40,000,000	50,000,000	
	<input type="radio"/>							

End of survey

Thank you for your help! Through your participation, the researchers will be able to identify opportunities for increasing the value of U.S. hardwood exports to Asia and Western Europe.

All data obtained from participants will be kept **confidential** and will only be reported in an aggregate format (by reporting only combined results and never reporting individual ones). The data collected will be stored securely until it has been deleted by the primary investigator.

If you would like to obtain a summary of the results, please provide your name and email address.

Name:

Email address: