Exports of U.S. Hardwood Products: Increasing Performance in Asia and Europe

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Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

In

Sustainable Biomaterials

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July 2nd, 2014

Blacksburg, Virginia U.S.A.

Key words: Hardwood Products, Export Performance, Competitiveness, International Marketing, Value Chain, Value added, Forest Products, Revenue Management

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ABSTRACT

The U.S. hardwood industry has traditionally depended on the domestic demand to sustain levels of production above 14 billion board feet per year. Because of the collapse of the U.S. housing market in 2009 and the economic recession that followed, the industry moved its sight to the international markets, as an opportunity to replace some lost demand, and pursue long term growth. Previous research on international marketing of hardwood products indicates that, there is a growing concern among U.S. companies to understand the main competitiveness factors in key markets such as Asia and Europe. Finding opportunities to add value to U.S. hardwood exports has been the goal of this research project. A case study and survey research were carried out among importers and exporters, whereby it was found that aspects related to price, quality and service, are critical in achieving competitive advantage. This motivated a study in demand and pricing management, which found that these tasks may be subject to innovation through optimization approaches.

Acknowledgements

First and foremost, I would like to thank God for giving me and my family this opportunity, which changed our lives forever.

To my wife, Marcela, whose unconditional love and support have meant the world to me. Without her, this dissertation would not have been possible.

To my daughter, Verónica, who came into our lives as I was beginning this research, for bringing us joy, inspiration and amazement; and whose countless sleepless nights prepared me in great deal to write this dissertation.

I am deeply grateful to Don Alejandro Cruz, for all his support and advice in finding this life opportunity.

I would like to thank my graduate advisor, Dr. Henry Quesada-Pineda, for his teachings, guidance, patience, and for believing in me and my work. Thanks to him, I rejoined academia after ten years away. My wife and I are both grateful.

Many thanks to Dr. Robert Smith, for his counsel, support and for keeping this work with its feet on the ground. Special thanks to committee members Dr. Debbie Cook and Dr. Earl Kline, for their contribution, ideas and listening. I would also like to recognize the Department of Sustainable Biomaterials at Virginia Tech, for becoming my second home over the past three years, and for supporting this work. I am grateful to Angela Riegel, for all her administrative support and help to improve my writing. Special thanks to Scott Lyon, Adrienn Andersch, Shawn Crawford, Melissa Brenes and Oxana Brenes, for their help and advice.

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1 INTRODUCTION OF STUDY

The goal of this research is to identify opportunities to increase the competitiveness of U.S. hardwood firms in Asia and Western Europe. This study will build upon previous research by incorporating the revision of commonly accepted competitiveness factors associated to exports, but will also contribute to the international marketing body of knowledge by exploring the effect of non-traditional factors such as pricing management, and economic, cultural, social and regulatory factors. The research project consists of three phases. In the first phase, hardwood importing companies were interviewed, with the purpose of determining which aspects of the products and services offered by their suppliers, they value the most (chapter two). Similarly, the second phase involved asking U.S. hardwood exporting firms, which aspects of the business relationship they perceived to have the greatest impact in their competitiveness in international markets (chapter three). Finally, a case study designed to explore the management of pricing in the hardwood lumber industry that took place in phase three (chapter four) will be explained. The last chapter of this dissertation (chapter five) summarizes the conclusions of the study, and provides a set of recommendations for their practical application in the industry. Further details on the problem statement and research design, are presented in the current chapter.

1.1 Background U.S. Hardwood Industry

1.1.1 Industry Definition

According to the North American Industry Classification System (NAICS), the wood product manufacturing subsector comprises those producers of lumber, plywood, veneer, wood flooring, and wood trusses, among others (United States. Census Bureau, 2012b). This subsector, which belongs to the Manufacturing sector, is subdivided in three main industry groups:

- *Sawmills and Wood Preservation;*

- *Veneer, Plywood, and Engineered Wood Product Manufacturing; and*

- *Other Wood Product Manufacturing.*

The *Sawmills and Wood preservation* group includes those establishments that transform logs and bolts into wood boards, dimension lumber, beams, poles, ties, siding, wood chips, etc. The *Veneer, Plywood, and Engineered Wood Product Manufacturing* group industry comprises producers of veneers (thin layers of wood) and laminated wood products. *Other Wood Product Manufacturing Industry* group is made up of establishments primarily engaged in manufacturing millwork, wood windows and doors, wood containers, pallets, floors, among others (United States. Census Bureau, 2012a). Figure 1.1 provides some examples of products supplied by each one of these industry groups mentioned (NAICS number in parenthesis).
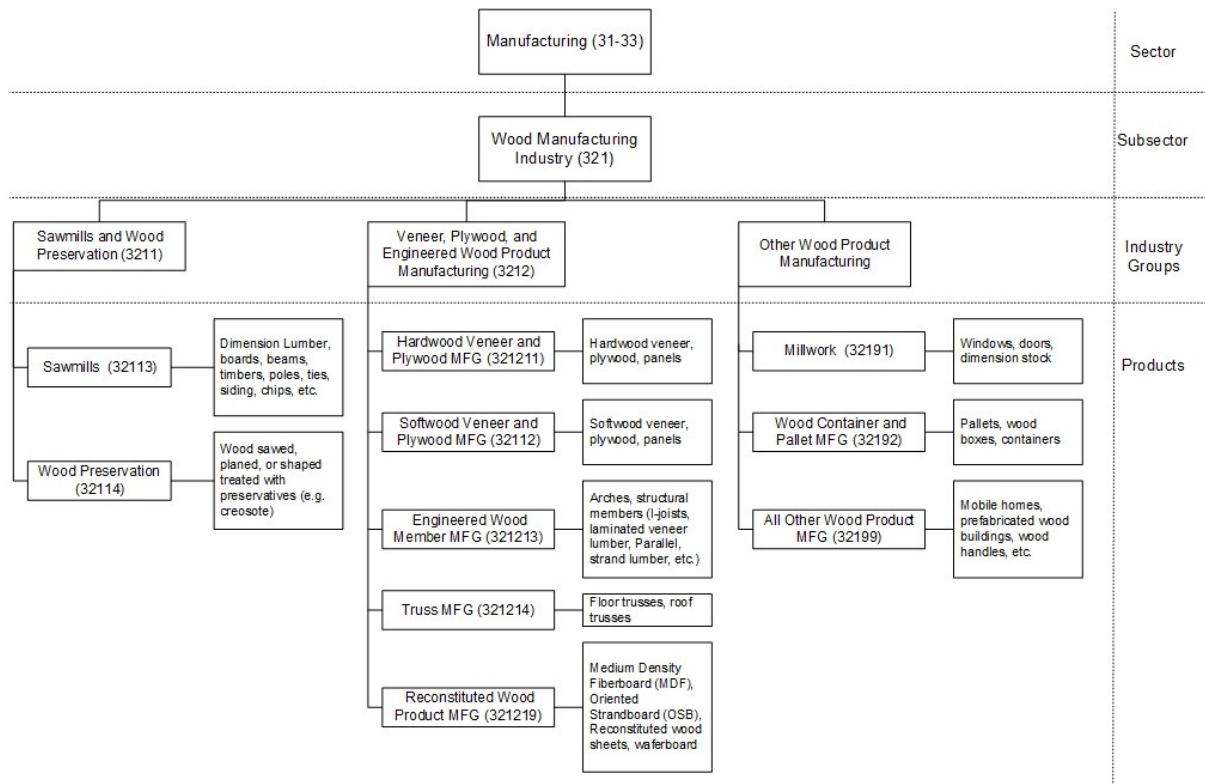
Figure 1.1. 2012 NAICS Wood Manufacturing Subsector structure (United States. Census Bureau, 2012a)

Wood scientists have classified the tree species consumed by these industry groups into two main categories based on their anatomical characteristics: hardwoods (angiosperms) and softwoods (gymnosperms) (Knovel & Forest Products, 1999). Botanically, angiosperm trees have their seeds enclosed in the ovary of the flower, whereas softwoods do not. The hardwood-softwood categorization should not be taken literally since it does not always refer to the hardness of the wood. Softwood trees, also called evergreens or conifers; are preferred by the construction industry for its strength, lightness and length (Jacobs, 2012). Examples of softwood trees are pine, larch, fir, hemlock, redwood, cypress, cedar, and Douglas-fir. Hardwood trees are usually deciduous (i.e. they lose their leaves in the Fall/Autumn) and are commonly used in manufacturing furniture, cabinets, paneling and flooring among others. The hardwood species consumed by the

U.S. manufacturing industry include ash, aspen, beech, birch, cherry, chestnut, elm, hickory, maple, oak, sweet gum, walnut, etc. (Jacobs, 2012). In general, the NAICS does not differentiate industry groups by the category of wood species used in their production processes. The only exception is made in the *veneer, plywood, and engineered wood product manufacturing* group, where veneer and plywood establishments are separated in *hardwood and softwood manufacturing* (United States. Census Bureau, 2012a).

This research will focus on the industry of U.S. hardwood products, and more specifically, on the international trade of lumber with Europe and Asia. Therefore, in order to define the unit of study of this research; it becomes necessary to define the concept of "*Hardwood Industry*". Based on the industry classification provided by U.S. Census Bureau, and the definition of "hardwood" established by the United States Department of Agriculture (USDA) through the Forest Products Laboratory, the term *hardwood industry* is conceptualized as a the group of establishments that employ hardwood as a primary raw material to manufacture products such as logs, lumber, plywood, veneers, and containers. It is important to note that according to the U.S. Census Bureau's industry classification system, *hardwood industry* would fall in the category of Sub-sector, since it encompasses several industry groups: 1) *Sawmills and Wood Preservation*; 2) *Veneer, Plywood, and Engineered Wood Product Manufacturing*; and 3) *Other Wood Product Manufacturing*; and it also belongs to the *Manufacturing* Sector (NAICS 31-33). However, in order to follow the common jargon used in this business, the term *hardwood industry* will continue to be used to refer to the *Hardwood Manufacturing Sub-Sector*.

1.1.2 U.S. Hardwood Products Supply Chain

A supply chain can be defined as the group of organizations or individuals that participate in the upstream and downstream flows of products, services, finances and information, from the source to a customer (Mentzer, DeWitt, S. Keebler, & Min, 2001). Note the three key elements are encompassed by this definition: a) upstream flows correspond to the "supply" activities of supply chain, b) downstream flows correspond to the "distribution" portion of supply chain and c) the customer as the "final" part of the supply chain. Forest products supply chains, can be described as large networks in which wood fiber is progressively transformed into consumer products (D'Amours, Ronnqvist, & Weintraub, 2008). A generic hardwood products supply chain, adapted from D'Amours et al (2008), is depicted in Figure 1.2. According to this model, the initial activities of this supply chain are performed by logging companies, which buy and lease log-harvesting equipment and vehicles to fell trees, and then transport them as sawlogs to the sawmills (Neville, 2013). In the next stage of the supply chain, sawmill companies saw the logs into, dimension lumber, boards, beams, bolts, poles, shingles, siding and wood chips. The lumber boards, which will be discussed later in this chapter, constitute the most of the fiber flow in this supply chain, are then air-dried and kiln-dried. Once the lumber meets the desired moisture content level, it is planned in finishing lines (D'Amours et al., 2008) and then distributed through the downstream flows, where it is converted into other hardwood products, before reaching the final consumer. Other products, such as veneers and wood chips, which are directly obtained from hardwood logs as well, are also depicted by Figure 1.2.
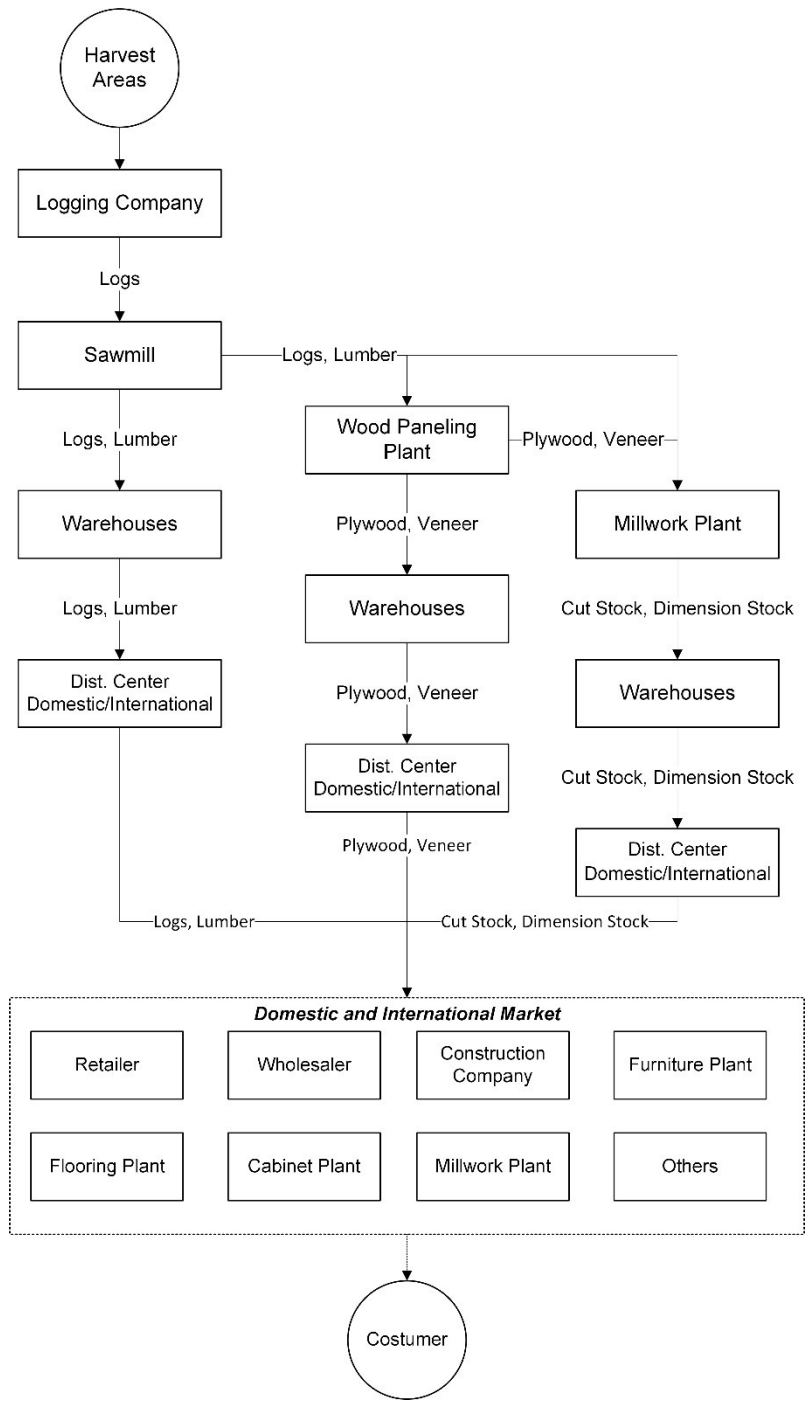
Figure 1.2 Generic U.S. Hardwood Supply Chain (simplified)

1.1.3 U. S. Hardwood Resources

There are 751 million acres of forest land in the United States. Most of these forests (92 percent approximately) are of natural origin (i.e. regenerated naturally from existing trees) while only 8 percent is planted nationally. 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 Sates comes from the harvest of local public and private forests lands. At least 56 percent of U.S. forests are in private hands –approximately 423 million acres as of 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 their primary ownership objective. The remaining 44 percent (328 million acres) are public where the Forest Service and USDA manage most of them (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, of which 92 percent 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 percent of all timber volume, and approximately 2 percent is in dead trees suitable enough for commercial trade.

Hardwoods account for 403 billion cubic feet (around 43 percent) of all growing-stock in the United States, which means that majority of growing-stock (57 percent) is softwood (529 billion cubic feet). Most of the production of softwoods is concentrated in the west of the United States. This region accounts for 43 percent of all U.S softwoods growing stock. In contrast, almost the entire production of hardwood timber (90 percent) comes from the eastern states, where the south central, southeastern 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 (Smith et al., 2009). The remaining 10 percent of the hardwood production is located in the western region. Private ownership of timber lands (corporate and non-corporate) accounts 78 percent of hardwood growing stocks in United States (41 percent of softwoods). The Figure 1.3 depicts the major wood-producing regions, according to the U.S. Forest Service, in its 2007 Resource Planning Act (RPA) assessment(Smith, Miles, Perry, & Pugh, 2007) .
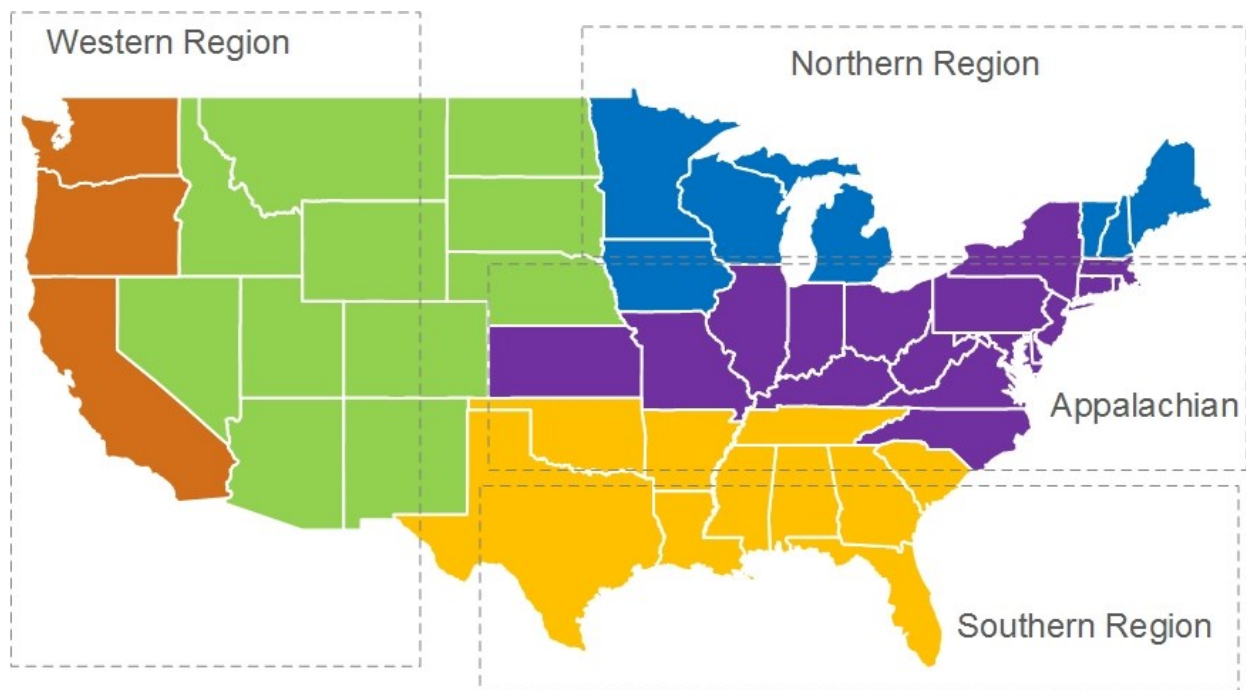
Figure 1.3. 2010 USDA RPA Assessment Major Regions (Smith et al., 2009)

More than thirty two species of domestic hardwoods are currently being exploited by the 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, customers tend to deal only with a limited amount of suppliers. Table 1.1 provides an overview of major resources of U.S. hardwoods according to the geographical area (U.S. Forest Products Laboratory, 2010). Oak is the most common genus; it accounts for 125 billion cubic feet (31 percent of all hardwood volume). Maples occupy the next place in abundance, accounting for 63 billion cubic feet (16 percent 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

1.1.4   Business Performance: Domestic Market

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

The level of housing starts Figure 1.4, a critical hardwood business economic driver, was 554,000 in 2009: this is the lowest level observed in the last 50 years (Woodall et al., 2011) and represents only 27 percent of that in 2005 (historical maximum), and 40 percent of the average of last 39 years. The U.S. hardwood lumber production (Figure 1.5), which peaked in 1999 at an estimated 14.1 billion board feet (BBF), recorded in 2009 the lowest production since 1960 at 6.2 BBF –a drop of 56 percent versus 1999, driving a 37 percent reduction in employment in wood manufacturing (Bureau of Labor Statistics, 2014).
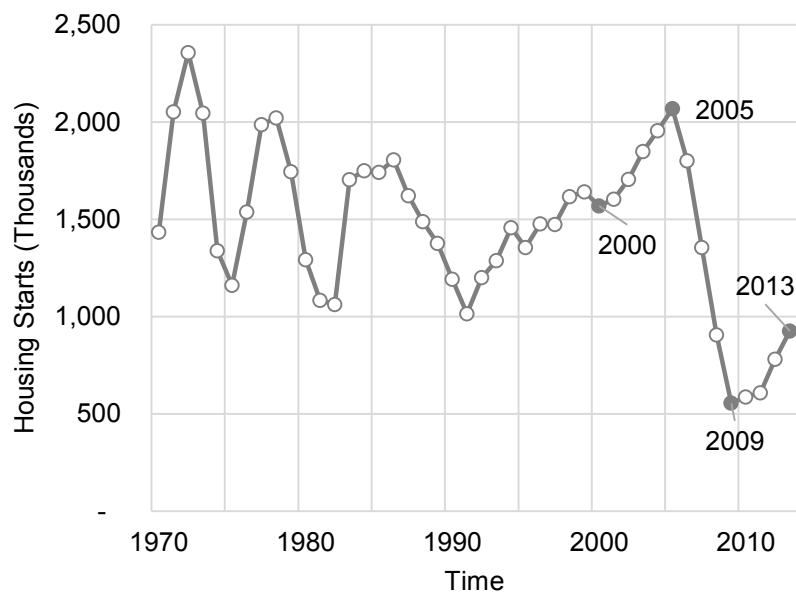
Figure 1.4. U.S. Housing Starts (U.S. Census Bureau, 2013)

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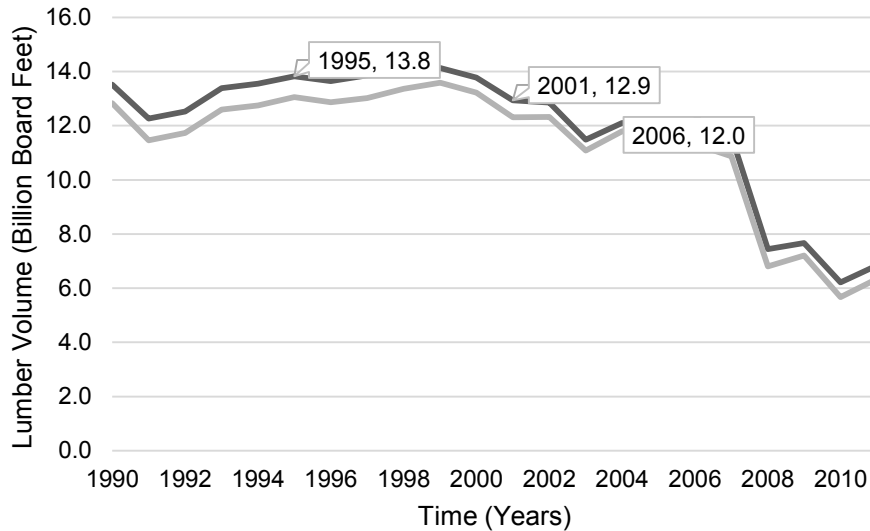
Figure 1.5. U.S. Hardwood Lumber: Total Production, 1994-2011 (Howard & Westby, 2013)

Despite the efforts of the federal government to incentive economic expansion through stimulus spending, the economic growth slowed following cutbacks in the federal government cash infusions. The single-family housing starts did not perform well in 2011 compared to 2010; they showed a decrease of 10.1 percent (HMR, 2012). New home completions, commonly associated with sales of furnishing and interior fittings, decreased 11.6 percent in 2011 from 2010 (HMR, 2012). In general, 2011 showed decrease in consumption of furniture, molding and mill work, cabinets, 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).

1.1.5   Business Performance: International Markets

1.1.5.1   Importance of Exports

The demand from international markets, has not come to raise the U.S. hardwood industry's production levels to match the past decade's records, but it has certainly become a key factor in sustaining and ensuring the growth of this industry (HMR, 2012).   In terms of volume, the production of U.S. hardwood lumber decreased approximately 6.7 BBF between 1999 and 2008 (47 percent), and its consumption was also reduced in 6.8 BBF (50 percent).   However, a change in this trend had been observed between 2008 and 2011 (Figure 1.6), where the production remained at a minimum of 6.8 BBF.   As it can be observed in Figure 1.7, the consumption of U.S. hardwood products is driven by seven industries: pallets, furniture, mill work, cabinets, flooring, railway ties, and exports.   Between 1999 and 2005, pallets, cabinets, flooring and exports accounted for 71 percent of the total hardwood consumption (38, 11, 11 and 12 percent respectively).   For the period between 2008 and 2011 in particular, the only three industries that presented a sustained growth in lumber consumption were pallets, railway ties and exports, whereas the others showed a progressive decline.   This condition indicates that the change in the trend of total hardwood lumber consumption, corresponding to the 2008 – 2011 period, has been driven by these three markets.

The nationwide and regional trends in the U.S. forest products sector point to some structural changes that may be difficult to reverse, but also point to some potential prospects for growth. A full "recovery" of housing construction to previous peak levels (more than 1.5 million) is not expected to occur within the next decade, but a gradual and modest rebound in housing starts is widely anticipated (NAHB 2012). Meanwhile, the general improvement in U.S. net exports of

wood products offers another prospect for future growth as long as it does not come at the cost of

off shoring skilled domestic secondary jobs (Woodall et al., 2011).
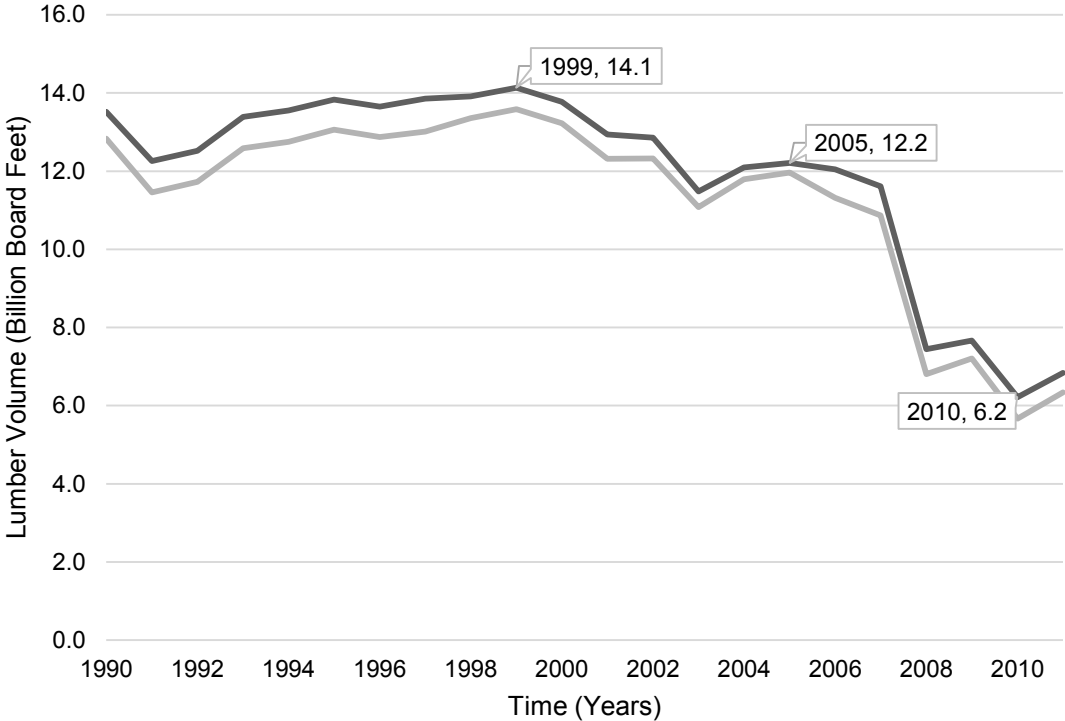
Figure 1.6. Production & Consumption of U.S. Hardwood Lumber (Howard & Westby, 2013)
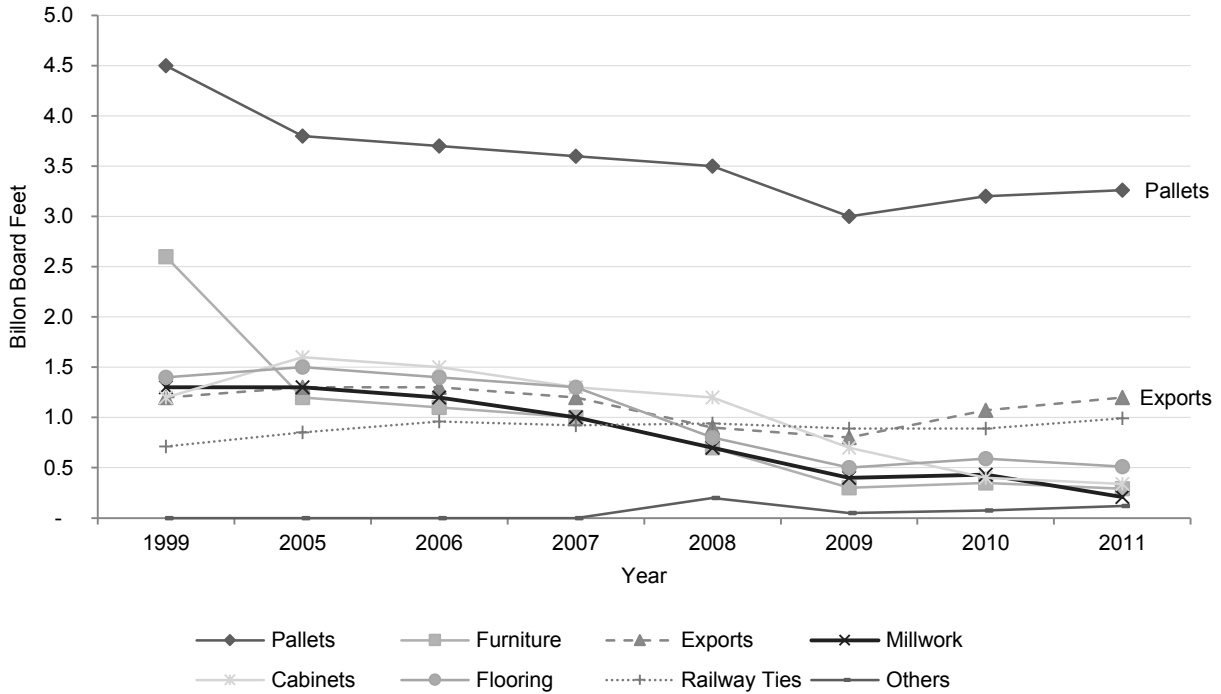
Figure 1.7 Estimates of Consumption of US Hardwoods (HMR, 2012)

1.1.5.2   Primary vs. Secondary Products

Figure 1.8 depicts the composition of hardwood exports between 2000 and 2013, in terms of value. During the last five yeasr of this period, exports grew from 1.9 billion USD in 2009, to 2.99 billion USD in 2013, which represents a total increase of 58 percent. Most of the U.S. hardwood traded internationally, consists of primary products such as logs and lumber, whose combined value represents almost 80 percent of the total U.S. hardwood exports. United States is the second largest exporter of non-coniferous sawed wood (after Thailand), which as of 2012, holds a worldwide market share of 12.06 percent (FAO, 2014). Hardwood lumber exports, in particular, totaled 1.5 billion board feet (BBF) in 2013, besting 2006 by almost 10 percent. This set a new yearly record (FAS, 2014), which indicates that the demand for U.S. hardwood primary products such as lumber,

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not only remain remains strong (Table 1.2) , but as it will be covered in next section, still represents an opportunity for growth in this industry sector. The purpose of this research is to explore such opportunities for growth in the export market.
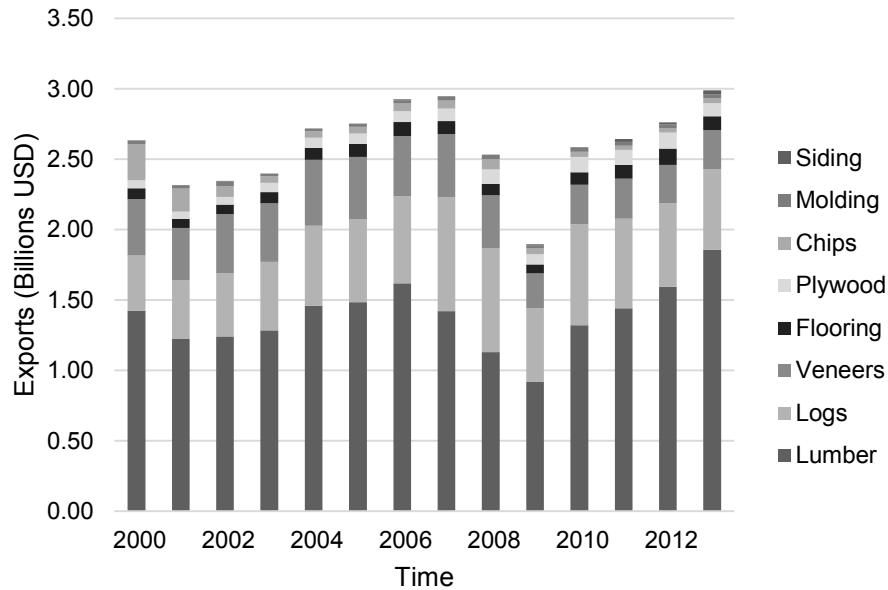
Figure 1.8. U.S. Hardwood Exports By Product: 2000 - 2012 (FAS, 2014)

Table 1.2 U.S. Hardwood Exports By Product: Descriptive statistics 2000 - 2013 (FAS, 2014)

Metric	Product (Billions of BF)*							
	Lumber	Logs	Veneers	Flooring	Plywood	Chips	Molding	Siding
Mean	1.39	0.58	0.37	0.09	0.08	0.07	0.03	0.01
Median	1.42	0.58	0.39	0.09	0.08	0.05	0.03	0.00
Min	0.92	0.39	0.25	0.06	0.05	0.03	0.02	0.00
Max	1.86	0.81	0.47	0.12	0.11	0.26	0.04	0.03
Range	0.94	0.42	0.22	0.05	0.06	0.23	0.02	0.03
Standard Deviation	0.22	0.12	0.07	0.01	0.02	0.06	0.01	0.01
Coefficient of Variation	15.93%	20.20%	20.34%	17.14%	23.78%	86.45%	20.87%	109.95%

*Except the last row (coefficient of variation), which is expressed as a percentage.

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1.1.5.3   Composition of International Markets

According to the U.S. Foreign Agricultural Service (FAS), between 2000 and 2013, approximately 96 percent of U.S. hardwood exports were concentrated in 5 main geographic regions: North America (Canada & Mexico), East Asia Southeast Asia, the European Union and Middle East (FAS, 2014). Figure 1.10 depicts the distribution of exports per geographic region. Traditionally, North America has been an important market for U.S. hardwood. Canada and Mexico together represented a 35 percent of U.S. hardwood exports between 2000 and 2013, in terms of value. On average, almost 30 percent of this demand corresponded to Canada, and 5 percent to Mexico. When compared against other regions, North America is characterized by the stability on its demand since 2000: its coefficient of variation for this time frame amounts to 14 percent only, whereas the same indicators for East Asia and Southeast Asia, are 30 and 36 percent respectively. In fact, the industry has observed more aggressive trends in consumption coming from other regions. Within this timeframe, exports to East Asia grew from 0.62 to 1.25 billion USD, which represents an increase of 100 percent, and a 42 percent of the total hardwood exports in 2013. A more drastic increase was observed in Southeast Asia, where exports grew from 0.10 to 0.28 billion USD, for an increase of 191 percent, and a 9.53 percent of the hardwood exports. Europe remain as the third most important market for U.S. hardwood, representing 13.94 percent of the U.S. hardwood exports in 2013, in spite of suffering a total decrease 50 percent since 2000.
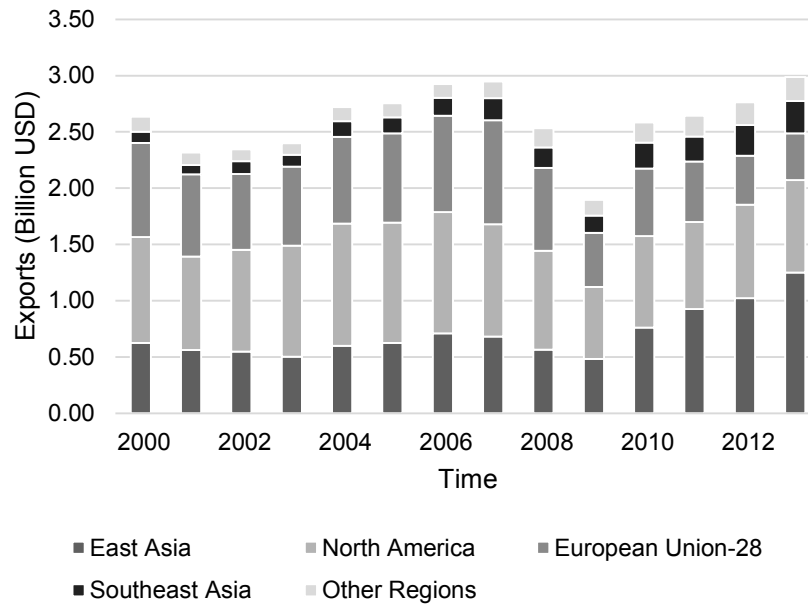
Figure 1.9 Exports U.S. Hardwood Products by Geographic Region 2000 - 2013

Table 1.3 2000 - 2013 U.S. Hardwood Exports: Descriptive Statistics by Region (FAS, 2014)

Metric (Billion USD)	Geographic Region				
	East Asia	North America	European Union	Southeast Asia	Other Regions
Mean	0.70	0.90	0.68	0.17	0.15
Median	0.63	0.89	0.72	0.16	0.14
Min	0.48	0.64	0.42	0.08	0.10
Max	1.25	1.09	0.93	0.28	0.22
Range	0.77	0.45	0.51	0.20	0.11
Standard Deviation	0.21	0.13	0.16	0.06	0.04
Coefficient of Variation (%)	30%	14%	23%	36%	24%

According to the statistics published by FAS , "*China is now by far the biggest player across the board*" (Hornsby, 2012). Between 1999 and 2006, China's consumption of US hardwood jumped from 50 MBF to 250-300 MFB (759.4 percentage points), in part because of the migration of the furniture manufacturing from Mexico to China, and the U.S. housing boom of 2003 to 2005. By the end of 2013, China accounted for 36.18 percent of the exports of U.S. hardwood products in terms of value (FAS, 2014). Historically, China has imported hardwood from US to produce

furniture and flooring for later export. However, this trend is changing: some of the finished goods are staying in China to feed the emerging middle class' demand (Hornsby, 2012). China imported a higher volume of lumber than the European Union (EU) between 2006 and 2009 (Europe still led in terms of value), and in 2010 surpassed the EU in terms of volume and value (Hornsby, 2012). In 2011, China imported $506 million; Canada followed with $240 million, EU stayed in third place with $284 million (Hornsby, 2012). 2011 also marks the time where China became the most important US hardwood logs importer; $251 million, while Canada reported $84 million and the EU $144 million (Hornsby, 2012).
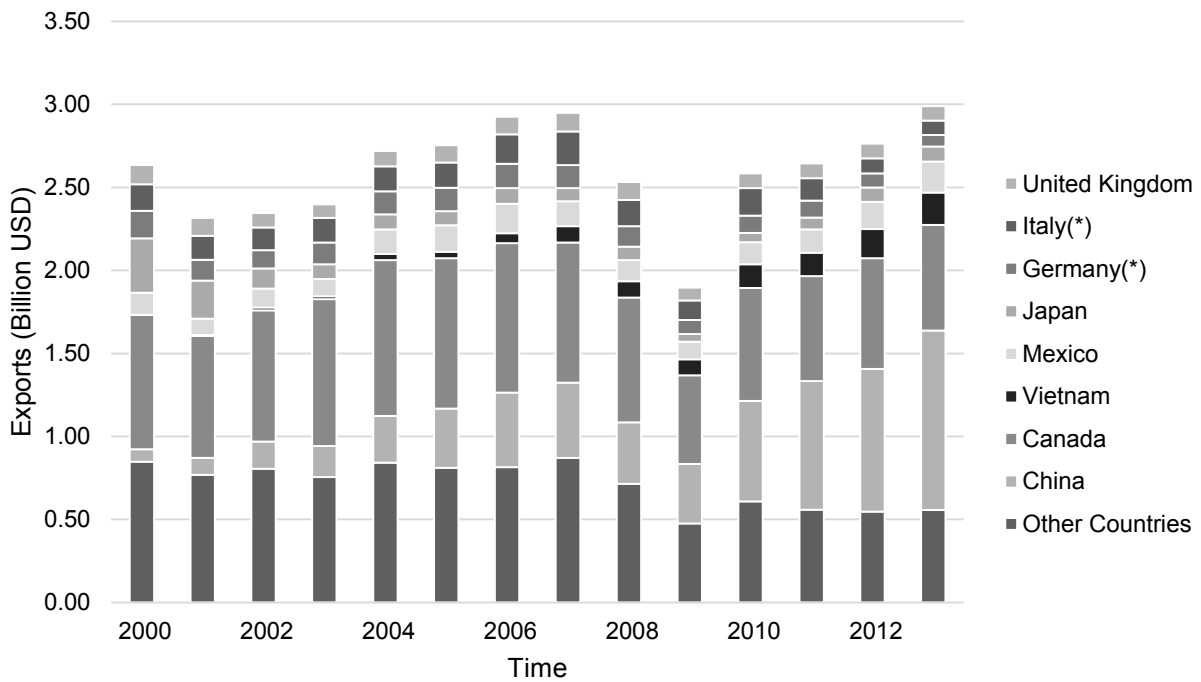
Figure 1.10. US Hardwood Exports from 2000 to 2013 by Country

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These numbers put in perspective that at the regional level, Asia and Western Europe represent an attractive opportunity for U.S. growth in the export market. For example, U.S. hardwood lumber accounted for only a 20 percent of total Chinese imports in 2010. According to the *Hardwood Leader* (Hardwood Review, 2012), around 280 million Chinese will move from the country to the cities in the next decade, increasing the consumption of housing and furniture, and consequently, of raw materials such as hardwood lumber and logs. The demand coming from Europe, is also anticipated to grow, as the U.S. hardwood industry has demonstrated compliance with the regulations, implemented by the former to fight the commercialization of illegally-sourced wood. It is because of the importance of these two regions, and the fact that previous research has been conducted to address the exports business in North America (Parhizkar, 2008), that this study is focused on Asia and Europe only.

1.2   Problem Statement

The success or failure of a business venture depends largely on competition. There are forces that shape competition in every industry, which determine the appropriateness of a firm's activities to favorably contribute to its performance by enhancing its position (Porter, 1985). In order to formulate a strategy to compete in any given industry, it is necessary to understand the factors that determine the relative position of a company within the industry. In other words, firms need to understand how competitive advantage is won or lost in a given context.

International competition, in particular, has multiple implications for the development of competitive strategies, which have been the subject of multiple research and theorized in multiple forms (Porter, 1986). The main implication relates to the fact that competition changes from industry to industry, country to country, and region to region. This makes necessary the study of

the driving forces in each context so that appropriate strategies to gain advantage may be formulated.

From this perspective, firms need to understand what it takes to be successful exporter 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 is still fragmented, diverse and inconsistent in results. Most previous research has been focused on multiple industries, rather than on single cases, and studies on *export performance* in hardwood products are practically non-existing. A comprehensive *export performance* theory is yet to be defined, and specific aspects of the value chain are yet to be studied, particularly, in the hardwood industry.

A better understanding of the factors affecting the competitiveness of U.S. hardwood companies in overseas markets is necessary to develop specific marketing strategies by region, according to the prevailing conditions in those markets. Previous research indicates that hardwood lumber companies are concerned about the globalization of markets, foreign competition in export markets (Buehlmann, Bumgardner, Schuler, & Barford, 2007), market-specific information (Hammett & Deforest, 1993; Ifju & Bush, 1994), international marketing and competitiveness models (Lyon, 2011).

1.3 Literature Review

In this section of the document, an initial review of the literature on competitiveness and export performance models is conducted as a means for developing the theoretical framework that will serve as the basis for designing this research project. Separate literature reviews were conducted to address the specific topics approached in each of the following chapters. The section 1.7 describes the organization of this document in more detail.

1.3.1 Competitiveness and Value Creation

In order to move and organization from its current state to a new stronger one, business strategies need to be formulated to improve the organization's competitiveness (Feurer & Chaharbaghi, 1994). The capabilities and competences that an organization possess to persuade a customer to prefer its products and services over the competition are the essence of competitiveness. To understand these capabilities and competencies, and their potential to deliver competitive advantage, the organization cannot be seen as a whole. Instead, it needs to be regarded as a collection of discrete activities, which are performed in alignment with the organization's business strategies. *Value chain* is a tool designed by Porter (Porter, 1985) to systematically divide a firm into its "strategically relevant" activities, analyze their behavior and interaction, and determine their importance in the implementation of business strategies. The term *value* is utilized in this context to denote the potential of these activities to deliver the firm's value proposition (Kaplan & Norton, 2000). In Porter's model, depicted in Figure 1.11, the value chain activities can be divided in two categories: *primary* activities and support activities. The *primary* activities are those related to the physical creation and delivery of the product to the customer, whereas support activities are involved in the procurement and management of the resources needed by the *primary* activities to operate.
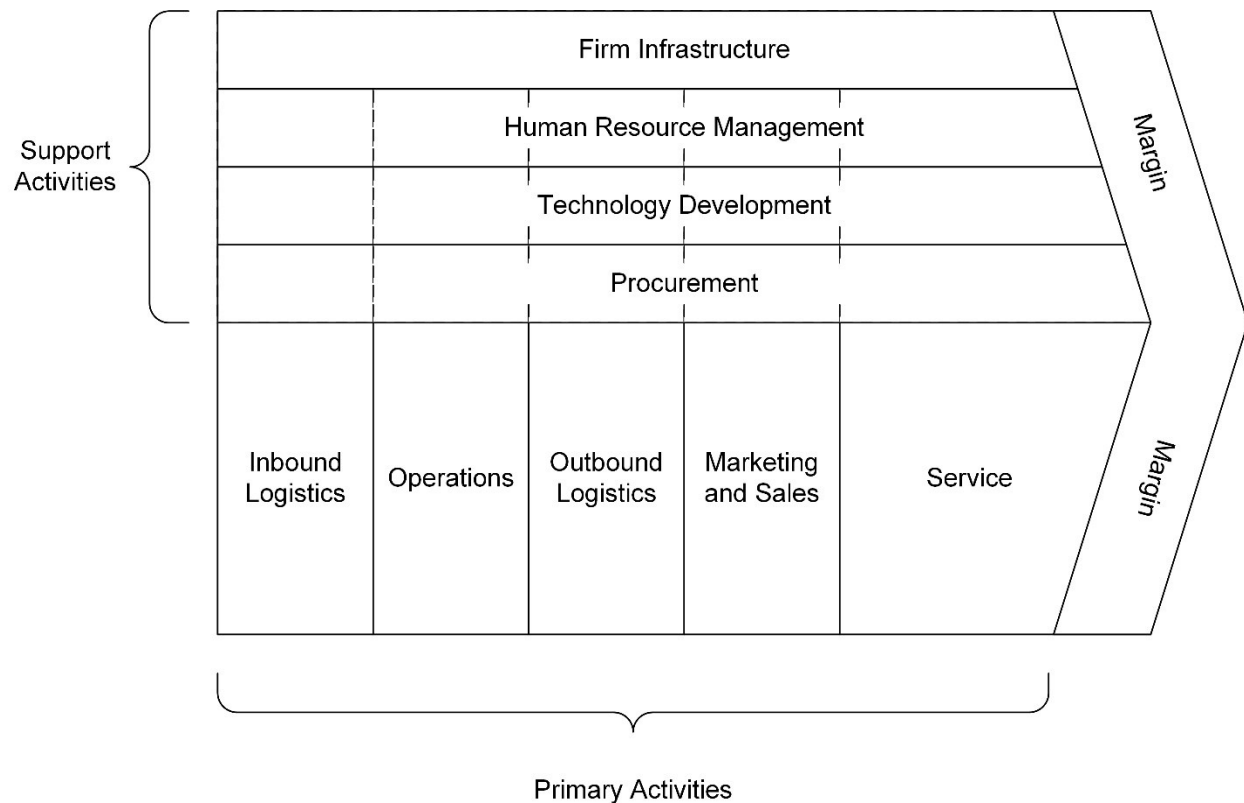
Figure 1.11 The Generic Value Chain

According to this model, value is created by operating a firm in such a way that the end product or service, has built-in features, for which the customers are willing to pay a price. Bowman et al. argue that *value* may actually take two forms: the *exchange value*, which corresponds to the model just explained; and the *perceived value*, which is subjectively determined by the customer (Bowman & Ambrosini, 2000). Under this paradigm, the value of the characteristics of products and services, varies from one context to another (e.g. by region or stage in the product life cycle). This variability in the value of a product or service, is addressed by Hill in his order winner/order qualifier framework (Hill, 2000). In accord with Hill's model, which was originated in the field of manufacturing theory (Hofmann, Beck, Füger, & SpringerLink, 2013), the order qualifiers represent aspects of a product or service required for a customer to consider buying it. The order winners on the other hand, consist in characteristics that position the product or service above those

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of the competition. Understanding the difference between these two concepts, and how they materialize in any given industry, is critical for an organization's strategic planning process. Therefore, understanding such aspects of the hardwood export business is one of the main themes of this research project.

The concepts presented up to this point in the literature review – value chain, order winners and qualifiers, are based on the assumption that attaining competitive advantage depends on the organization's resources, *value* activities, on the characteristics of products and services, and how these are valued by customers. However, previous research on international marketing also suggests that, the context in which the firms operate, both locally and internationally, along with the characteristics of the organization themselves, play a key role in its competitiveness. This field of study has coined the term "*export performance*" to address the factors that determine the success of a firm in achieving its objectives in international markets. Which for the purpose of this study, will be considered as synonym of international competitiveness and will be discussed in the following section.

1.3.2   Determinants of Export Performance

International marketing encompasses the business disciplines focused on the trade of goods and services across global boundaries (CharlesDoyle, 2011). Studying the determinants of *export 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. Some consider that knowledge on this field is fragmented, diverse, and sometimes even inconsistent, which makes *export performance* one of the most contentious fields in international marketing (Katsikeas, Leonidou, & Morgan, 2000). The

globalization of businesses, and the importance of exports for industries such as the U.S. hardwood products, justify and incentive additional research in pursue of a better understanding of the factors that determine the success of export ventures (Parhizkar, Miller, & Smith, 2010).

There have been several studies that attempted to revise the existing literature on *export performance*, for example: (Leonidou, Katsikeas, & Samiee, 2002; Sousa & Martínez-López, 2008; Zou & Stan, 1998). These studies provide a perspective on what factors have been proposed as determinants of *export performance*. Sousa, in particular, studied the literature between 1998 and 2005, and developed a framework that condenses the results of 52 papers in the *export performance* literature (Sousa & Martínez-López, 2008). In general, Sousa found that most of the attempts to develop a framework to explain *export performance* suggests the presence of at least four elements: internal factors, external factors, control variables and moderating variables. The internal factors relate to multiple dimensions of the firm: firm characteristics (e.g. size, international experience, market orientation, etc.), export marketing strategy (e.g. product, price, promotion, distribution, etc.) and management characteristics (e.g. export commitment and support, education, international experience, etc.). External factors relate to the environment that surrounds the firm, domestically and internationally: foreign market characteristics (e.g. legal and political, environmental turbulence, cultural similarity, etc.) and domestic market characteristics (e.g. export assistance). Control factors (variables) may be either internal or external factors that are of no interest for researcher, but need to be controlled in order to suppress any potential effect in the study.

Leonidou et al. (Leonidou et al., 2002) contributed to the study of *export performance* with two highly-cited meta-analyses of literature available in the field, one published in 2002 and the latest one circulated in 2010. Their findings support the notion that deficiencies found by Sousa (2008)

in *export performance* inhibits the progress in the field. According to their study, *export performance* was the dominant topic of research in the 1990s, achieving its highest in the 2000s. They observed a trend on criticism due to the problematic of establishing a proper measure of performance either at the firm or venture level; and that export variables can be categorized in three sets and a simple model for *export performance*, which depends on the internal and external factors of the firm, and the marketing strategies as well. Katsikeas et al. (Katsikeas et al., 2000) encountered more than forty *export performance* metrics in a review of one hundred articles, most of them published in the 1990s. They concluded that *export performance* measures suffer from serious conceptual, methodological and practical limitations. Most of the articles included in the study used metrics selected arbitrarily, sometimes following the work of other researchers and without considering any contextual factor. In this sense Katsikeas recommends to follow a contingent approach: the conditions of the study should dictate the nature of the metrics used to quantify *export performance*, and the selection should be multidimensional to realize the strength of each metric.

1.3.3   Theoretical Framework

The literature in *export performance* reveals several trends in the international marketing literature. In general, it is found that performance seems to be determined by factors both external and internal to the firm. The internal factors may include the characteristics of the firm and the management team; which is found to be consistent with the *value chain* model described in the previous section. According to the models of competitiveness addressed in section 1.3.1, and organization can be understood as a collection of resources, which are processed through value chain activities to deliver products and services to the customers. The customers, in turn,

determine the value of these, according to specific characteristics which can be grouped as order winners and order qualifiers. The external factors on the other hand, involve the elements that characterize the foreign market. Figure 1.12 depicts the summary of the factors discussed in this review of literature, as a means for establishing a theoretical model.
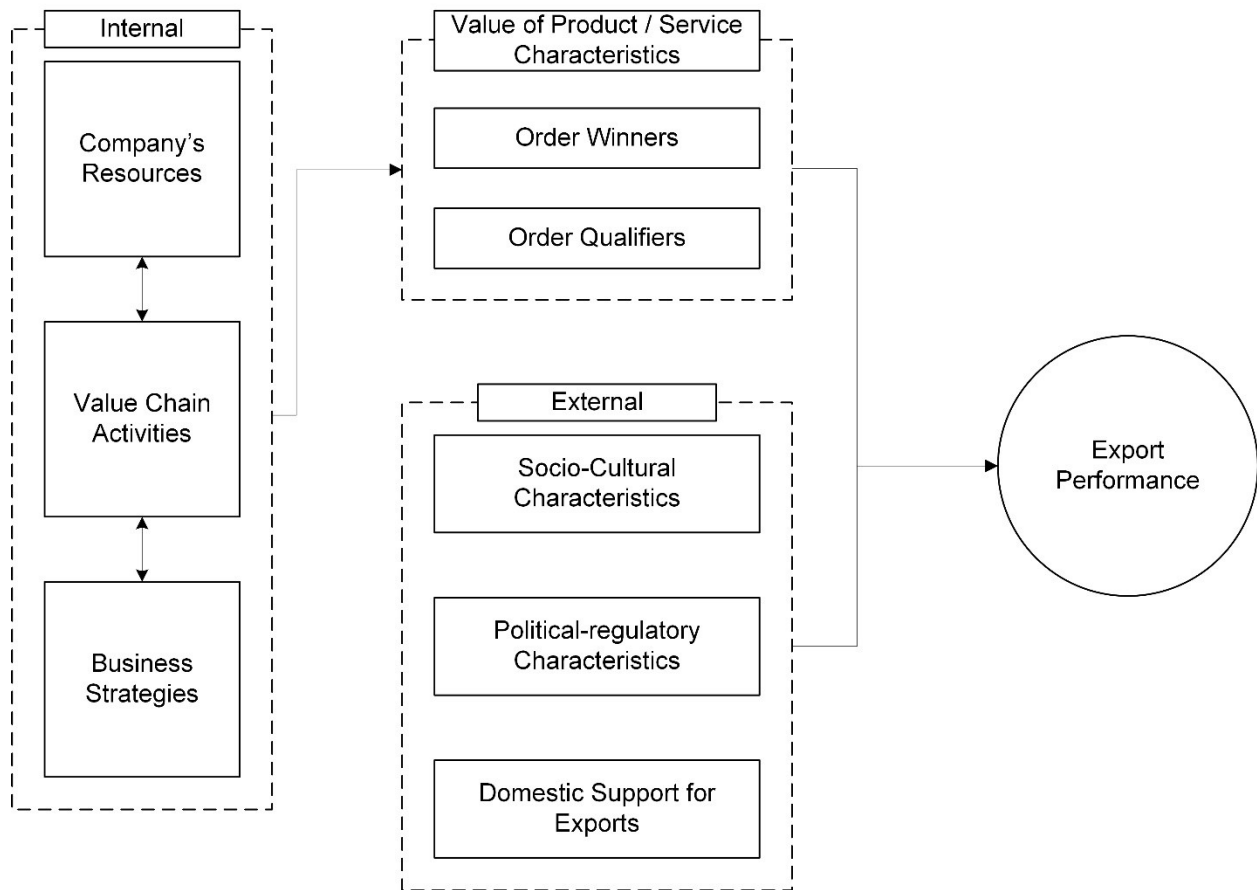
Figure 1.12 Theoretical Framework: *Export performance* Model

1.4   Research Questions

The following questions have been formulated to address the needs and opportunities of the U.S.

hardwood industry described in the problem statement and will serve to guide this research project.

- What characteristics of the products and services delivered U.S. hardwood lumber companies, are valued the most by customers in Asia and Europe?
  - How do these characteristics influence *export performance*?
- What external factors determine the *export performance* of U.S. hardwood firms in Asia and Europe?
- How can the answers of the previous questions help exporters, trade associations and government agencies take the necessary actions to improve performance?

1.5   Objectives

1.5.1   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 (Figure 1.13).
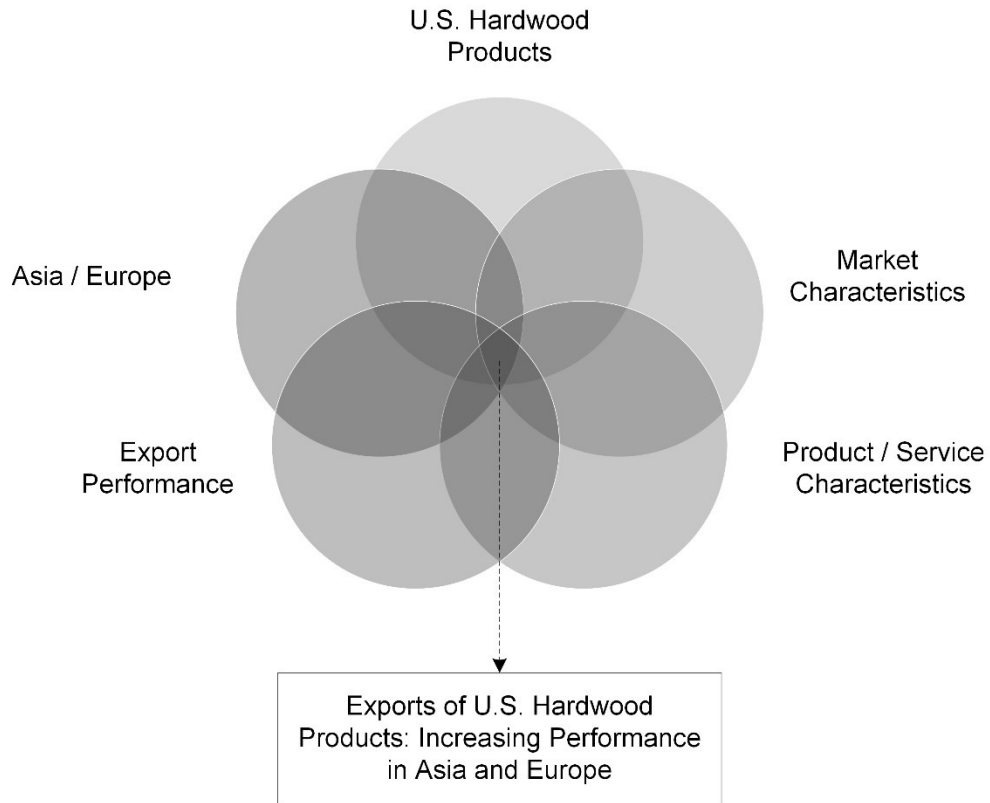
Figure 1.13. Research Project Focus Areas

1.5.2   Specific Objectives

1.5.2.1   Phase 1

- 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

1.5.2.2   Phase 2

- 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.

1.5.2.3   Phase 3

- 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

1.6   Overview of the Study Design (Methodology)

This research project consisted of three main phases, each one intended to address the specific objectives presented in section 1.5.2 (Figure 1.14). In phase one, 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 two, 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 one 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 depicted by Figure 1.12 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 will be discussed in detail in the next two chapters, 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 three 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
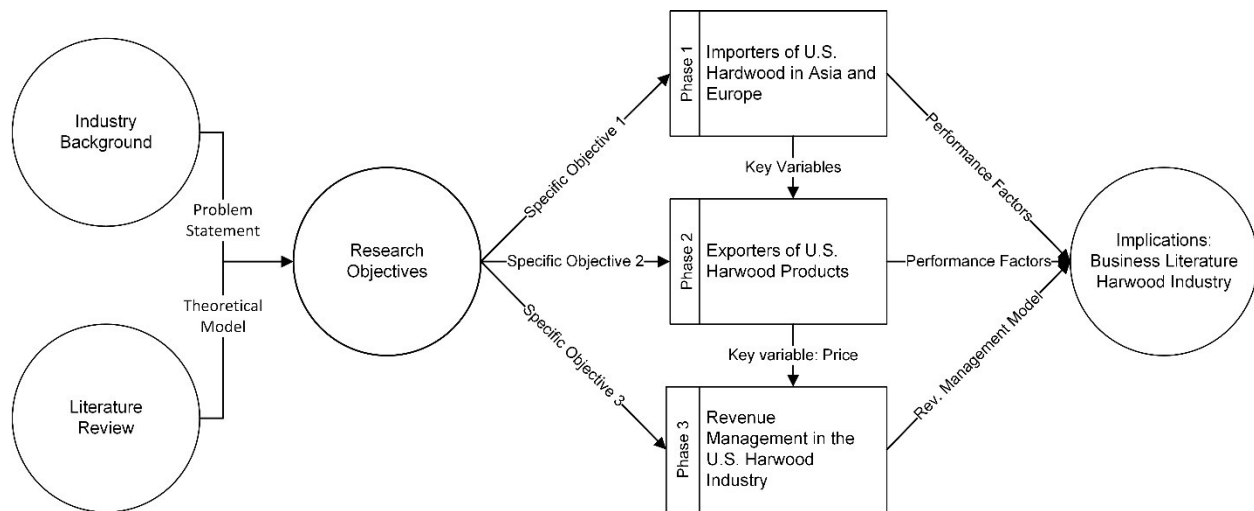
Figure 1.14 Overview of Study Design (Methodology)

1.7 Organization of this Document

The remaining content of this document is organized as follows. Chapter two covers the phase one of this study, and phases two and three are addressed in chapters three and four respectively. These three chapters were written following a manuscript format, established by the Graduate School at Virginia Tech, which implies that each chapter self-contained its: abstract, introduction, literature review, methodology, results, discussion, conclusions and references. This approach was chosen because chapters two to four correspond to individual papers, which will be submitted to peer-reviewed journals. Therefore, the reader will find some recurrent themes, particularly in the introduction, background, and literature presented in these chapters, even though an effort has been made to keep repetition to the minimum, by preserving only the main elements that justify this study and its design. The appendixes have been placed at the end of the document. Chapter five, provides a summary of conclusions, implications, limitations, and future research.

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2 ADDING VALUE IN THE INTERNATIONAL HARDWOOD MARKET: THE IMPORTER'S PERSPECTIVE

Abstract

The U.S. hardwood industry suffered a continued decline since 1999, in part as a consequence of the collapse of the domestic housing market, and the overall economic recession that followed. Improvements in the domestic and global economies have led to a slow recovery of this industry. Exports, in particular, have not come to raise the industry's total production levels to match 1999 records, but they have certainly become a key market for short and long term growth. Firms need to have a good understanding of the characteristics and dynamics of international markets to formulate proper strategies to increase growth and improve profits. The purpose of this study is to determine the factors that create competitive advantage in Asia and Europe, two of the biggest markets for U.S. hardwood products. The data collection and analysis was carried out through a case study, which involved applying interviews to hardwood importing companies in selected trade fairs abroad. Four main dimensions have been found in this study, to have a potential impact on *export performance*: characteristics of the Product, Service, Market and Firm (supplier). It has also been found that product-related 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.

2.1   Introduction

2.1.1   Background: U.S. Hardwood Industry

The U.S. hardwood lumber industry has been in decline since 1999, in part as a consequence of the collapse of the domestic housing market, and the overall economic recession that followed. Sawmill closures, a 37 percent reduction in employment in wood manufacturing (Bureau of Labor Statistics, 2014), and a 53 percent decrease in hardwood production (Hardwood Review, 2012) are some of the difficulties that the industry faced at the end of the first decade of the 21st century.

The U.S. domestic housing starts (Figure 2.1) –a critical economic driver for the hardwood business, started to decline in 2006, falling from a historic record of 2.07 million starts in 2005, to 554 thousand starts in 2009: this is the lowest level observed in the last 50 years (Woodall et al., 2011) which represents only 27 percent of the housing starts in 2005, and 40 percent of the average of last 13 years. The estimated U.S. hardwood production (Figure 2.2), which peaked in 1999 at an approximate 12.9 billion board feet (BBF), recorded in 2010 the lowest production since 1960 at 5.7 BBF –a drop of minus 55 percent versus 1999 (Barford, 2012).
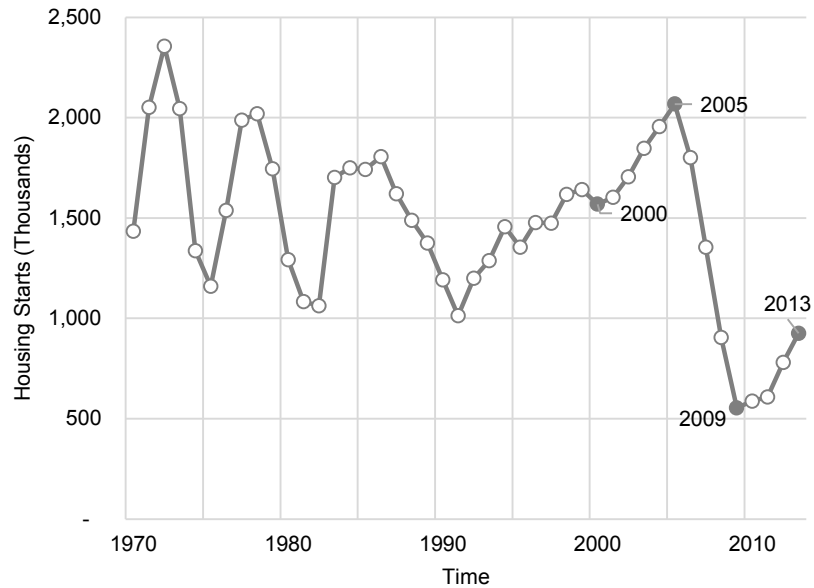
Figure 2.1 .U.S. Housing Starts (U.S. Census Bureau, 2013)

Despite of the efforts of US government to incentive economic expansion through stimulus spending, the economic growth slowed following cutbacks in the federal government cash infusions. New home starts in 2013, commonly associated with sales of furnishing and interior fittings, only account for a 45 percent of the same in 2005. The period between 1999 and 2011 showed decrease in consumption of furniture, molding and mill work, 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). In general, the conditions of the domestic markets have served as an incentive for the US hardwood industry to turn its sight to international markets, as an opportunity to replace some of the local demand lost after 2008 economic meltdown (Hornsby, 2012).
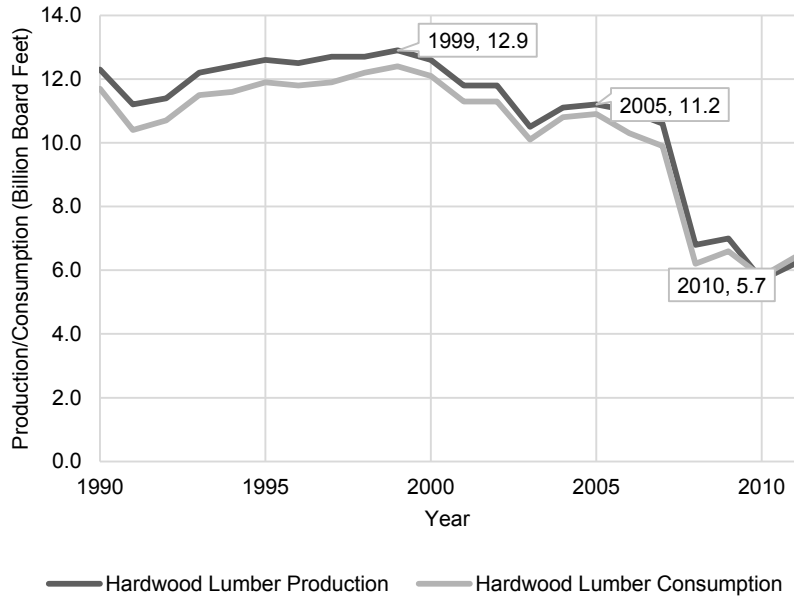
Figure 2.2. U.S. Hardwood Lumber Production & Consumption, 1990-2011 (Howard & Westby, 2013)
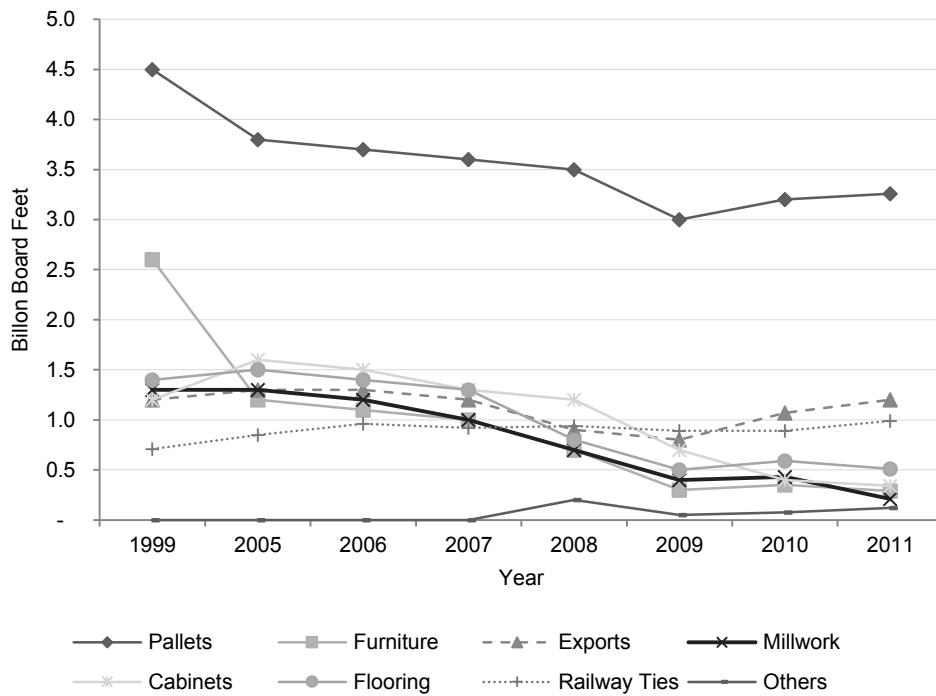
Figure 2.3. Estimates of Consumption of US Hardwoods (HMR, 2012)

2.1.2 Hardwood Exports

Improvements in the domestic and global economies have led to a slow recovery of the U.S. Hardwood Industry, particularly on traditional markets such as pallets and crates, and non-traditional markets, as the exports sector for instance. The international trade is expected to account for a 13.2 percent of the total industry revenue in 2014 (Goddard, 2014), thereby exports have become the second market in importance for the industry, only after pallets. The value of hardwood exports has increased from 1.89 billion USD in 2009 to 2.99 billion USD in 2013 – almost a 58 percent increase, which also signifies a 2.14 percent increase vs. 2006, the year that held the highest exporting record until now. Even though 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). Hence there is no question as to the growing importance of international markets

Fourteen species of American hardwoods have been reported to be traded internationally in the last thirteen years. In 2013, six species accounted for 81.26 percent of the value of all lumber exports: red oak (23.26%), white oak (17.77%), yellow poplar (14.35%), ash (10.79%), maple (7.73%) and walnut (7.35%) (FAS, 2014). Traditionally, red oak, white oak and poplar, have been the top three species also in terms of volume. Between 2010 and 2013, for example, these three species accounted for almost 57 percent of the total lumber exports - around 838.1 million board feet in 2013. In average, hardwood lumber has accounted for 53.1 percent of all hardwood exports since 2000, logs for 22.3 percent, veneers for 14.2 percent, and chips, flooring, molding, plywood and siding for the remaining 10.4 percent. The export activities of hardwood lumber has traditionally concentrated in five main geographic regions since 2000: East Asia, the European Union, North America and Southeast Asia, with a composition of exports in 2013 of 49.35%,

13.34%, 20.20% and 11.61% respectively (FAS, 2014). When compared against 2006 exports (previous record), East Asia represents a growth of almost 126.76 percent, thereby becoming not only the region with highest growth, but also the main importer of U.S. lumber in 2013. Southeast Asia also presented a significant growth between 2006 and 2013 - 91.31 percent. In contrast, regions traditionally important for the U.S. hardwood lumber industry have shown a decrease in the businesses. The European Union for instance, has seen its imports reduced by 50.82% between 2006 and 2013 (256.1 million USD). Similarly, North America (Canada and Mexico) has reduced their imports of hardwood lumber by 29.86% (158.4 million USD) for the same period. Nevertheless, exports to Canada, Mexico and the European Union represented almost a 42 percent of the total exports in 2013 therefore these regions, along with East Asia and Southeast Asia, remain key for the future growth of the American Harwood industry.

2.1.2.1 Problem Statement

Having a good understanding of the factors that drive *export performance* and improve competitiveness in international markets, is critical to the strategic and tactical planning processes. Previous research on the *export performance* field is extensive in the factors studied, and varied in the industries addressed, but a comprehensive theory is yet to be defined, and specific aspects of the business such as demand and supply chain management waiting yet to be studied, particularly, in the hardwood industry. In fact, previous research suggests that there is a growing concern among these firms, to stay up to date in the aspects that drive competitiveness in the main geographic regions. The goal of this research is to help the U.S. hardwood industry to uncover the elements that may help their businesses achieve competitive advantage in the export markets.

2.2   Literature Review

2.2.1   *Export performance*

International marketing encompasses the disciplines focused on the trade of goods and services across global boundaries (CharlesDoyle, 2011). 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. Some consider that knowledge on this field is fragmented, diverse, and in some instances inconsistent, which makes *export performance* one of the most contentious fields in international marketing (Katsikeas, Leonidou, & Morgan, 2000). Nevertheless, the globalization of businesses, the growing importance of international markets and the structural changes occurring in domestic economies, justify and motivate additional research in pursue of a better understanding of the factors that determine the success of export ventures (Parhizkar, Miller, & Smith, 2010).

There have been several studies that have attempted to revise the existing literature on *export performance* (Leonidou, Katsikeas, & Samiee, 2002; Shaoming & Simona, 1998; Sousa, Martínez-López, & Coelho, 2008). These studies provide a perspective about those factors which have been proposed as determinants of *export performance*. Sousa, in particular, studied the literature between 1998 and 2005, and developed a framework that condenses the results of 52 papers in the *export performance* literature (Sousa & Martínez-López, 2008). In general, Sousa found that most attempts of developing a framework to explain *export performance* indicate the presence of at least four elements: internal factors, external factors, control variables and moderating variables. The internal factors relate to multiple dimensions of the firm: firm characteristics (e.g. size, international experience, market orientation, etc.), export marketing strategy (e.g. product, price,

promotion, distribution, etc.) and management characteristics (e.g. export commitment and support, education, international experience, etc.). External factors relate to the environment that surrounds the firm, domestically and internationally: foreign market characteristics (e.g. legal and political, environmental turbulence, cultural similarity, etc.) and domestic market characteristics (e.g. export assistance). Control factors (variables) may be either internal or external factors that are of no interest for researcher, but need to be controlled in order to suppress any potential effect in the study. The selection of control variable depends on the research question, so one researcher's internal or external variable can be another researcher's control variable and vice versa. Finally, moderating variables are those that influence the relationship between independent and dependent variables. Not all studies accounted by Sousa's in his literature review include either control of moderating variables.

Leonidou et al (2002, 2010) contributed to the study of *export performance* with two highly-cited meta-analyses of literature available in the field, one published in 2002 and the latest one circulated in 2010. Their findings support the notion that deficiencies found by Sousa (2008) in *export performance* inhibits the progress in the field. According to their study, *export performance* was the dominant topic of research in the 1990s, achieving its highest in the 2000s. They observed multiple criticisms due to the problematic of establishing a proper measure of performance either at the firm or venture level. Katsikeas et al. (Katsikeas et al., 2000) encountered more than forty *export performance* metrics in a review of one hundred articles, most of them published in the 1990s. They concluded that *export performance* measures suffer from serious conceptual, methodological and practical limitations. Most of the articles included in the study used metrics selected arbitrarily, sometimes following the work of other researchers and without considering any contextual factor. In this sense Katsikeas recommends to follow a contingent approach: the

conditions of the study should dictate the nature of the metrics used to quantify *export performance*, and the selection should be multidimensional to realize the strength of each metric.

Leonidou and Sousa's models reveal some trends in *export performance* literature. In general, performance seems to be determined by factors both external and internal to the firm. The internal factors include the characteristics of the firm and the management team. The external factors on the other hand, involve the elements that typify the foreign market.

2.2.2   Theoretical Framework

The literature in *export performance* reveals several trends in the international marketing literature. In general, it is found that performance seems to be determined by factors both external and internal to the firm. The internal factors may include the characteristics of the firm and the management team; which is found to be consistent with the *value chain* model described in chapter one. According to the models of competitiveness addressed in section 1.3.1, and organization can be understood as a collection of resources, which are processed through value chain activities to deliver products and services to the customers. The customers, in turn, determine the value of these, according to specific characteristics which can be grouped as order winners and order qualifiers. The external factors on the other hand, involve the elements that characterize the foreign market. Figure 2.4 depicts the summary of the factors discussed in this review of literature, as a means for establishing a theoretical model.
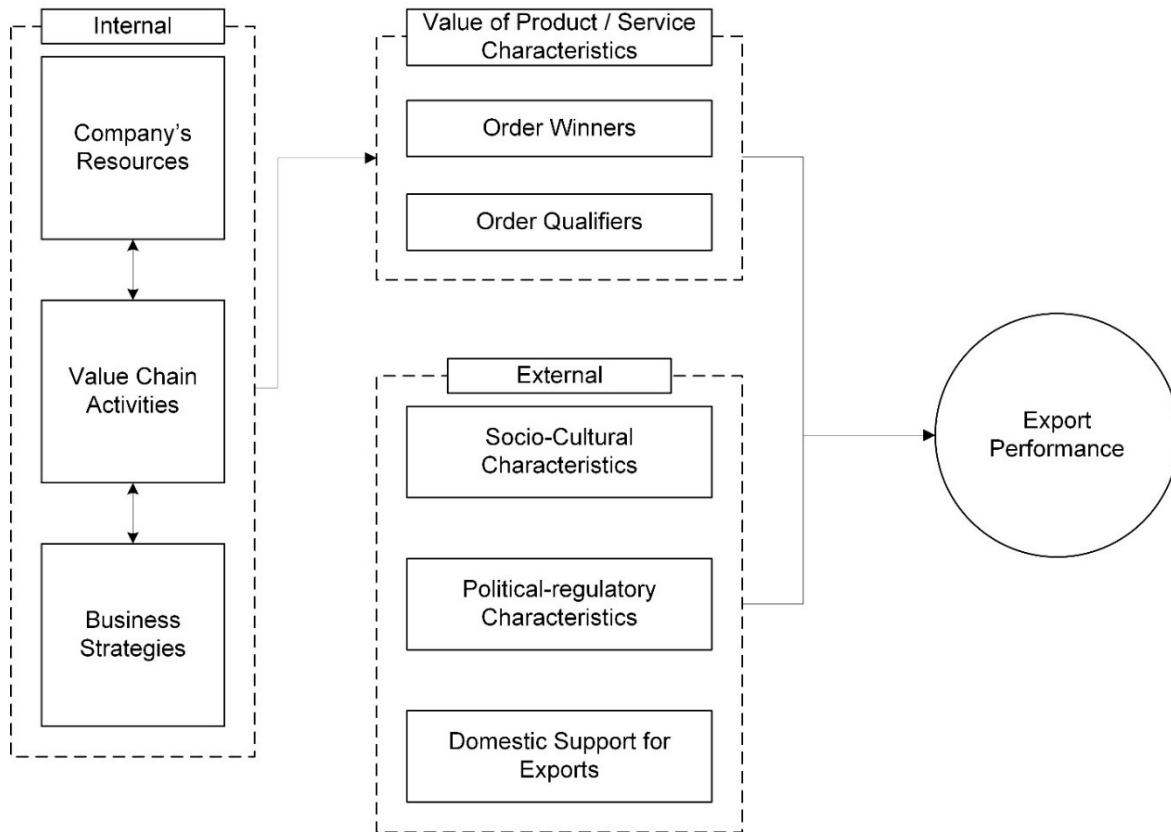
Figure 2.4 Theoretical Framework: *Export performance* Model

A better understanding of the factors affecting the competitiveness of U.S. hardwood companies in overseas markets, is necessary to develop specific marketing strategies by region, according to the prevailing conditions in those markets. Previous research indicates that hardwood lumber companies are concerned about the globalization of markets, foreign competition in export markets (Buehlmann, Bumgardner, Schuler, & Barford, 2007), market-specific information (Hammett & Deforest, 1993; Ifju & Bush, 1994), international marketing and competitiveness models (Lyon, 2011; Quesada-Pineda, Lyon, & Smith, 2014).

Considering the fact that previous research reveal similar trends in the *export performance* literature, and that this research proposal needs to build upon previous inquiries in the hardwood industry to contribute to the body of knowledge, the factors and categories which were proposed will be used to code and classify the data collected in the field work of this case study.

2.3   Methodology

A comparative case study (Jan & Tony, 2008) was implemented between January 2013 and October 2013 to explore 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. Harwood Industry. Similar studies have been implemented in the past to determine the export opportunities for hardwoods products from the Appalachian region in Central America (Lyon, 2011), and for the U.S. hardwood industry in general, in Mexico, Asia and Europe (Parhizkar et al., 2010). The main goal of this study is to gather insights from companies, about the state of the export business, its main drivers, opportunities for growth and challenges. The collection of data and analysis was carried out in a case study, which involved applying interviews to hardwood importing companies. The purpose of this phase is to capture the customers' opinions about the key of the products and services delivered by hardwood firms through value chain activities. The researchers targeted furniture firms that imported hardwood products. 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 and identified the companies which utilized hardwood products as raw materials. Three trade fairs were visited in the following order:

- Interzum's 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 American hardwood Exports. As it was mentioned in section 2.1.2, East Asia, the European Union, and Southeast Asia are the top four importing regions of U.S. hardwood lumber, along with North America. Considering the exploratory nature of this study, and the feasibility of doing strict probability sampling on the mentioned regions, the individual companies were following a non-probability sampling methodology (Babbie, 2010). Haphazard sampling –the technique used by the research team, is a valid research technique for exploratory studies, in particular for pretesting the adequacy of survey items for properly operationalizing concepts (Bernard, 1995). An initial set of wood-based products manufacturers were selected among the exhibitors of the cited trade fairs. These companies were approached by the research team, and interviews were carried out with the representatives once it was determined that 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 their hardwood suppliers. The first six items of the questionnaire refer to the characteristics of the respondent's firm, its suppliers and the products imported from that later. In questions seven to nine, the respondents are asked to mention the minimum requirements expected from the hardwood suppliers. In other words, these factors, which were conceptualized as *order qualifiers*" (Hofmann, Beck, Füger, & SpringerLink, 2013), represent the characteristics that a supplier must demonstrate for a customer to consider

establishing a business relationship. Question eight refers to those *order qualifiers* in which respondents believe their expectations have not been fully met in the past. Finally, question nine explores, the "*order winners*" –those characteristics of the product or service that motivates a customer to choose one supplier among its competitors (Hill, 2000). The Table 2.1 provides a summary of the questionnaire design.

Table 2.1 Questionnaire Design

Question		Variables		
#	Type	Name	Description	Type
1	Close-ended	Hardwood Importer	Groups respondents in importers and non-importers	Categorical
2	Open-ended	Respondent Position	Job performed by respondent	Categorical
3	Open-ended	Respondent Location	Country where respondent's firm is located	Categorical
4	Open-ended	Supplier Location	Country where main hardwood supplier of respondent's firm is located	Categorical
5	Open-ended	Hardwood Species	Hardwood species imported by respondent's firm	Categorical
6	Close-ended	Hardwood Product Types Imported	Hardwood products imported by respondent's firm	Categorical
7	Open-ended	Order Qualifier 1	Main factor considered by responding firm when choosing supplier	Categorical
8	Open-ended	Order Qualifier 2	Responding firm's expectations that have not been fulfilled by hardwood suppliers	Categorical
9	Open-ended	Order Winner	Opportunities for hardwood suppliers to add value	Categorical

As Table 2.1 indicates, the variables measured through the questionnaire are categorical (Ott & Longnecker, 2010), which means, each variable has a measurement scale consisting of a set of categories. In this study, categorical data analyses (Agresti, 2002) were conducted to explore the behavior of each individual variable and the potential relationships among them; which 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.

In categorical data analysis, the study of a single variable, can be performed by counting the number observations in each category, and then calculating the proportions for the sample, to infer the category probabilities (Agresti, 2007). When multiple variables are analyzed simultaneously, it is said that they form a multidimensional contingency table where each variable corresponds to 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-square test of independence, which validity has been accepted for cells with large number 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).

Due to the exploratory nature of this phase, testing were conducted with the purpose of establishing the importance of potential export performance factors and their associations with characteristics of the supplier customer and product, in order to determine the variables to be modeled in the second phase of this project. The following table summarized the hypotheses corresponding to these tests.

Table 2.2 List of Hypotheses of Phase 1

Independent Variable		Dependent Variable		Null Hypothesis (H_0)	Hypothesis
ID	Name	ID	Name		
VAR03.1	Respondent Country	VAR05	Product Species	Variables are independent	2-1
VAR04	Supplier Country			Variables are independent	2-2
VAR03.1	Respondent Country			Variables are independent	2-3
VAR03.2	Respondent Region	VAR06	Product Type	Variables are independent	2-4
VAR04	Supplier Country			Variables are independent	2-5
VAR03.1	Respondent Country			Variables are independent	2-6
VAR04	Supplier Country	VAR07.1	Order Qualifier Category	Variables are independent	2-7
VAR05	Product Species			Variables are independent	2-8
VAR06	Product Type			Variables are independent	2-9
VAR05	Product Species	VAR07.2	Order Qualifier	Variables are independent	2-10
VAR06	Product Type			Variables are independent	2-11

| Independent Variable | | Dependent Variable | | Null Hypothesis | Hypothesis |
ID	Name	ID	Name	(H_0)	
VAR03.1	Respondent Country			Variables are independent	2-12
VAR03.2	Respondent Region		Order Qualifier Category	Variables are independent	2-13
VAR04	Supplier Country	VAR08.1		Variables are independent	2-14
VAR05	Product Species			Variables are independent	2-15
VAR06	Product Type			Variables are independent	2-16
VAR03.1	Respondent Country			Variables are independent	2-17
VAR03.2	Respondent Region			Variables are independent	2-18
VAR04	Supplier Country	VAR08.2	Order Qualifier	Variables are independent	2-19
VAR05	Product Species			Variables are independent	2-20
VAR06	Product Type			Variables are independent	2-21
VAR03.1	Respondent Country			Variables are independent	2-22
VAR03.2	Respondent Region		Order Winner Category	Variables are independent	2-23
VAR04	Supplier Country	VAR09.1		Variables are independent	2-24
VAR05	Product Species			Variables are independent	2-25
VAR06	Product Type			Variables are independent	2-26
VAR03.1	Respondent Country			Variables are independent	2-27
VAR03.2	Respondent Region			Variables are independent	2-28
VAR04	Supplier Country	VAR09.2	Order Winner	Variables are independent	2-29
VAR05	Product Species			Variables are independent	2-30
VAR06	Product Type			Variables are independent	2-31

2.4   Results

A total of thirty-eight hardwood importing 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

2.3. Most of the responses come from companies interviewed at Interzum: 38.71 percent of

sample. Companies interviewed at IFF correspond to the second biggest sampling group in size:

32.26%, and the remaining 29.03 percent of responses were collected in VIWIF. Approximately 48 percent of the responses were provided by sales representatives, 16.13 percent by procurement employees, 9.68 percent of the answers come from marketing personnel and 12.91 percent from production managers, executives or business owners (12.90 percent or respondents preferred not to disclose their positions).

The majority of companies interviewed have their main production facilities located in East Asia (38.71 percent): 31.43 percent in China and 6.45 percent in Taiwan (Figure 2.5). The second major group in size corresponds to firms located in Europe (32.26%), which includes Germany with 16.13 percent and France, Italy and Holland with 6.45, 6.45 and 2.23 percent respectively. The remaining 29.04 percent of firms is distributed in Southeast Asia (9.68 percent), Middle East (6.45 percent), North America (6.45 percent) and South America (3.23 percent).

Table 2.3 Distribution of Respondents by Trade Fair Location

Trade Fair Location	Frequency	Percent	Cumulative Frequency	Cumulative Percent
China	10	32.26	10	32.26
Germany	12	38.71	22	70.97
Vietnam	9	29.03	31	100.00
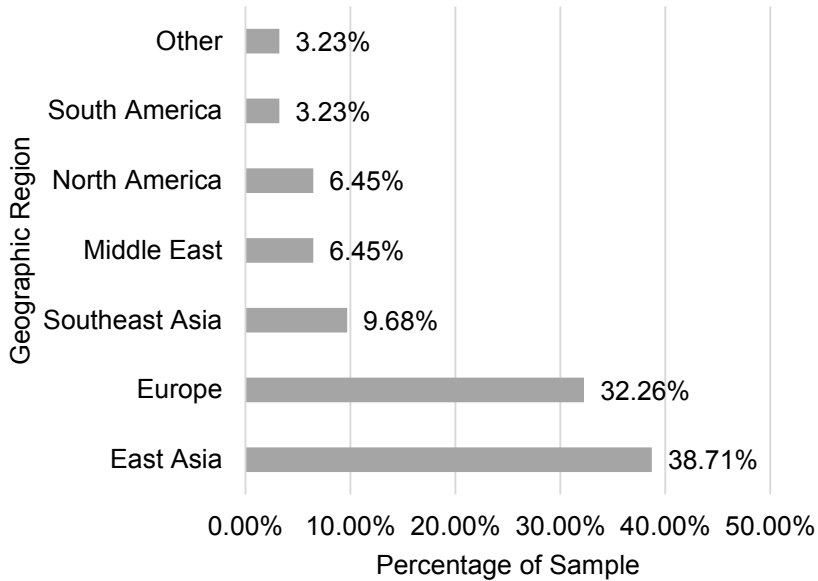
Figure 2.5 Distribution of Respondents by Geographic Region

When asked about the location of their firm's main supplier, respondents indicate that in 48.39 percent of the cases hardwood products are sourced from the United States (Figure 2.6). China accounts for 19.35 percent of responses, Thailand for 12.90 percent, Vietnam for 3.23 percent and the remaining 12.90 percent of cases correspond to other countries. The following item in the questionnaire asked for the three top species imported by interviewed firms. In 28.05 percent of the responses, a variety of oak was accounted as the main hardwood species traded; followed by ash and walnut with 10.98 percent of responses each. Table 2.4 depicts the distribution of imported hardwood species (see bottom row of table).
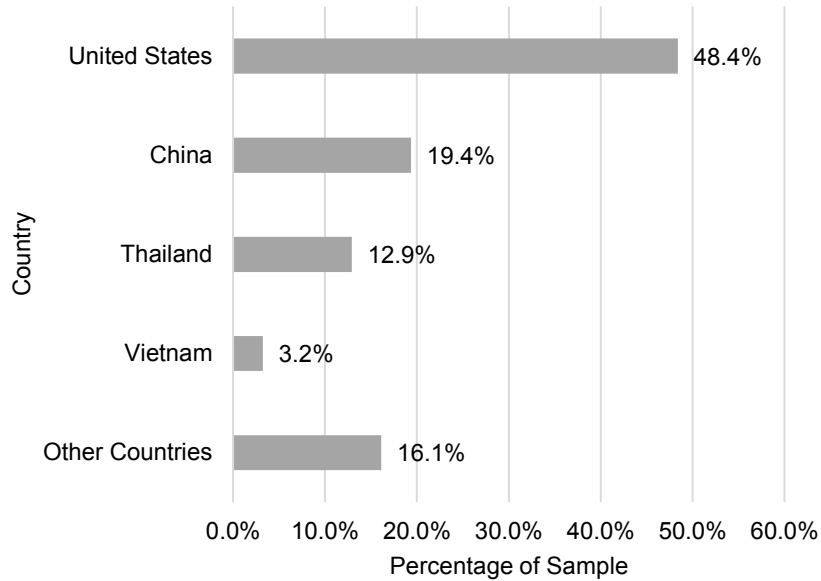
Figure 2.6 Distribution of Hardwood Suppliers by Country

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 (Agresti, 2002; Bilder & Loughin, 2004, 2009; Stokes, Davis, & Koch, 2000). Statistical independence was tested with Pearson Chi-Squared and Fisher's Exact Tests, the later 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 did not reject the null hypothesis that *species* are independent of the *respondent location*, with a significance level *alpha* of 0.05 (hypothesis 2-1). In other words, it appears that each geographic region shows similar preferences for hardwood species. Next, independence of traded species was also tested against the geographic location of suppliers (hypothesis 2-2). As it was expected, a p-value of 0.0005 obtained also with Fisher's Exact Test, indicates that the varieties of hardwood

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commercially traded are dependent on the supplier's location, with a significance level of also 0.05 (Table 2.4).

Table 2.4 Top hardwood species imported from major provider countries (proportions)

Supplier Country	Hardwood Species										
	Oak	Others	Ash	Walnut	Maple	Alder	Cherry	Poplar	Rubber Wood	Beech	Total
U.S.A	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

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 38.46 percent of answers, followed by logs, veneer and dimension lumber with 19.23, 15.38 and 15.38 percent respectively. Flooring and other products accounted for 11.53 percent 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 product as the response (dependent) variable, and respondent's location as the explanatory (independent) variable, for both country and geographic region levels (hypothesis 2-4). With a significance level *alpha* of 0.05, the test of *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* (hypothesis 2-3). Therefore,

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no significant statistical evidence was found to suggest that the type 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 is rejected with a significance level of 0.05 (2-5), because there is evidence that the type of hardwood products changes depending on the supplying country. In other words, different countries ship different mix of products:
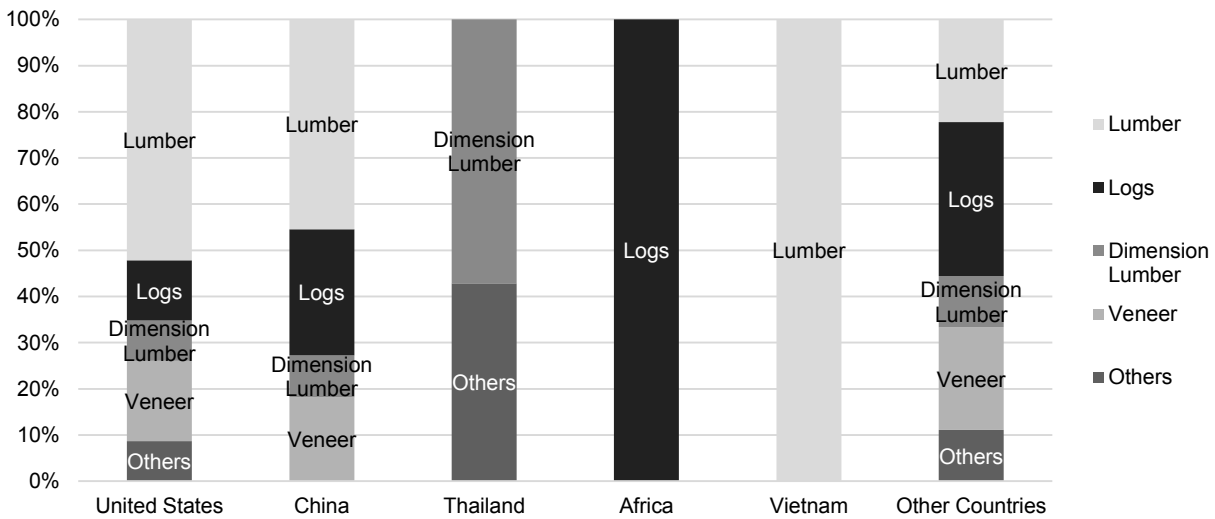
Figure 2.7 Hardwood products imported by interviewed firms

Questions previously discussed (one to six) refer to the characteristics of the firm and their procurement practices. In the following questions, respondents are inquired 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 the these to offer additional value. In question seven 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, will be named *order qualifiers*. Their answers to this open-end question were first coded into order qualifiers and then group in three main *Order Qualifier Categories*: *product characteristics*, *service characteristics*, *firm (supplier) characteristics* and *others*; according to the concepts of *export performance* studied in the literature review (Hill, 2000; Hofmann et al., 2013). A total of eighteen individual *order qualifiers* were coded by researchers, which are depicted in Figure 2.8. The category of *product characteristics* correspond to 65.08 percent of the responses obtained, whereas *service characteristics*, *firm characteristics* and *others* account for 28.57, 4.76 and 1.59 percent respectively. *Price* and *quality* stand out as the qualifiers with higher frequency counts -25.40 percent each, followed by *color*, *customer service* and *species availability* with 9.52, 7.94 and 6.35 percent respectively. The remaining 25.38 percent consists of six qualifiers, mostly within the *service characteristics*.
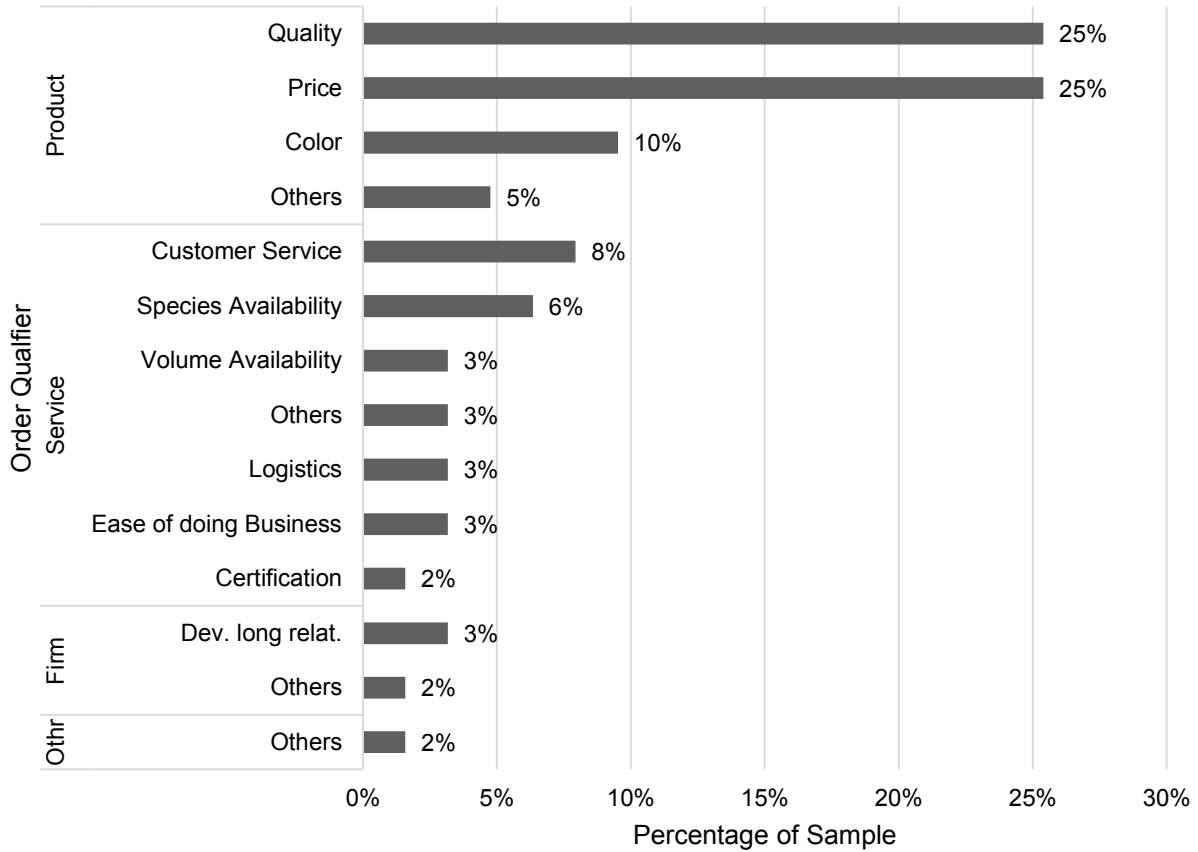
Figure 2.8 Question 7: Order Qualifiers

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 seven, and the respondent's location (hypothesis 2-6).   With a *p*-value of 0.3584, the researchers did not reject the null hypothesis, which states that proportions of above factor categories remain the same for all geographic regions. This means that the distribution of factor categories depicted in Figure 2.8 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 (hypothesis 2-7), resulted in a *p*-value of 0.6874 with a significance level of 0.05. Therefore, there

is not sufficient statistical evidence to reject the null hypothesis, which is that the distribution of *order qualifier* categories remains the same between suppliers (locations).

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* (hypothesis 2-8) resulted in a *p*-value of 0.2741, and the test conducted for *hardwood species* versus individual *order qualifiers* (hypothesis 2-10) in a *p*-value of 0.9140. With a significance level of 0.05, the researchers did not 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* (hypothesis 2-9 and 2-11 respectively), the researchers obtained *p*-values of 0.6951 and 0.7875, which indicate that the type of product has not significant effect on the qualifiers in general.

In question eight, 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 either features of the product supplied, the service, or the characteristics of the supplying firm. 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*. It is with the distinction, however, that the latter corresponds to aspects of the supplier, its products or services, where customer's expectations have not been fully met.
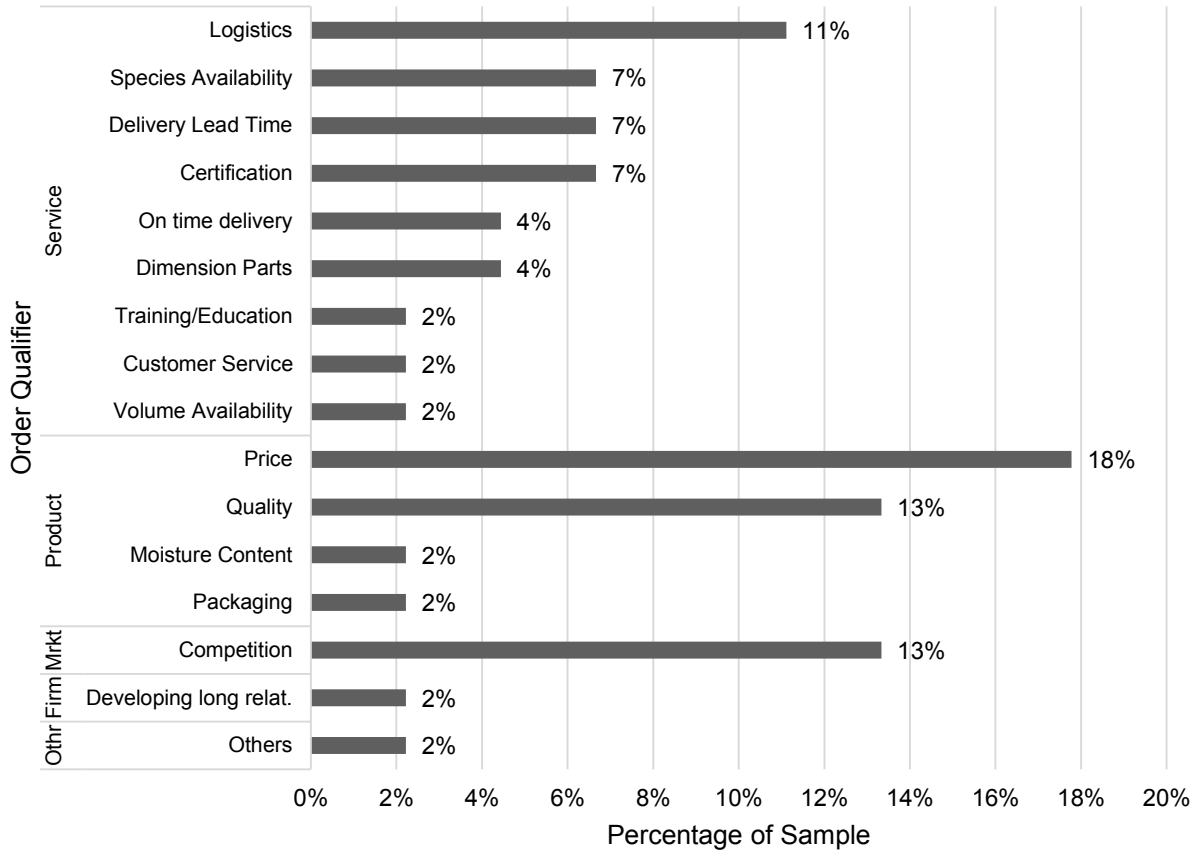
Figure 2.9 Question 8: Order Qualifiers

Figure 2.9 depicts the distribution of responses obtained in question 8. A total of 21 *orders*

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 percentages of sample responses are 46.67, 35.56, 13.33, 2.22 and 2.22

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 fail to meet their expectations in service-related *order qualifiers*

more frequently. The top five *order qualifiers* in frequency counts of responses are: *price* with

17.78 percent and *competition* with 13.33 percent, followed by *quality, logistics*, and *certification*, which represents 13.33, 11.11 and 6.67 respectively. These five items account for 62.22 percent of all responses, three of which correspond to price characteristics, one to service characteristics, and one 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 seven. Table 2.5 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. This signals the absence of associations between the qualifiers and the mentioned explanatory variables.

Table 2.5 Question 8: Independence Tests

Independent Variable	Dependent Variable		Hypotheses
	Order Qualifier Category	Order Qualifier	
	Fisher's Exact Test P-Value	Fisher's Exact Test P-Value	
Respondent's Country	0.3291	0.8949	2-12 and 2-17
Respondent's Region	0.3844	0.3390	2-13 and 2-18
Supplier's Country	0.0410	0.2900	2-14 and 2-19
Product Species (Top five)	0.7382	0.9849	2-15 and 2-20
Product Types	0.9831	0.7875	2-16 and 2-21

The last question of the survey is intended to measure *order winners*, rather than *order qualifiers*. In contrast to the latter, *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. The answers provided by respondents were coded into twenty order winners, which were categorized in: *service characteristics*, *product characteristics*, *firm*

characteristics, and *others*. Similar to the results observed in question eight, and in contrast with the same of question seven; most of the *order winners* fall within the category of *service characteristics*. These *order winners* account for 45.45 percent of responses, seconded by product-related *order winners* with 38.18, *supplier characteristics* with 3.64 percent, and *others* with 12.73 percent of all responses. The top five individual order winners are: *price, quality, species availability,* and *on-time delivery*; which account for 18.18, 16.36, 12.73, 10.91 and 90.09 percent of responses respectively. It is evident from the respondents' perspective that those areas where hardwood lumber companies may create additional value, correspond to the services that accompany the product. These results confirm that the two main aspects to increase competitive advantage are still price and quality, but they also bring a new perspective on the importance of service attributes. A complete list of *order winners* per category is presented in Figure 2.10.

Independence tests were conducted in question nine for the same combination of variables studied in the two preceding questions. Table 2.6 depicts the results obtained in each test. The *p*-values obtained in this round of analysis also indicate 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. In other words, the relative importance of the order qualifiers and winners described in this section, seems to prevail regardless of the customer or supplier's location. This indicates that those aspects of product and services needed to both entering the competition and gaining competitive advantage, are fairly similar for the two geographic regions addressed in this study (Asia and Europe).
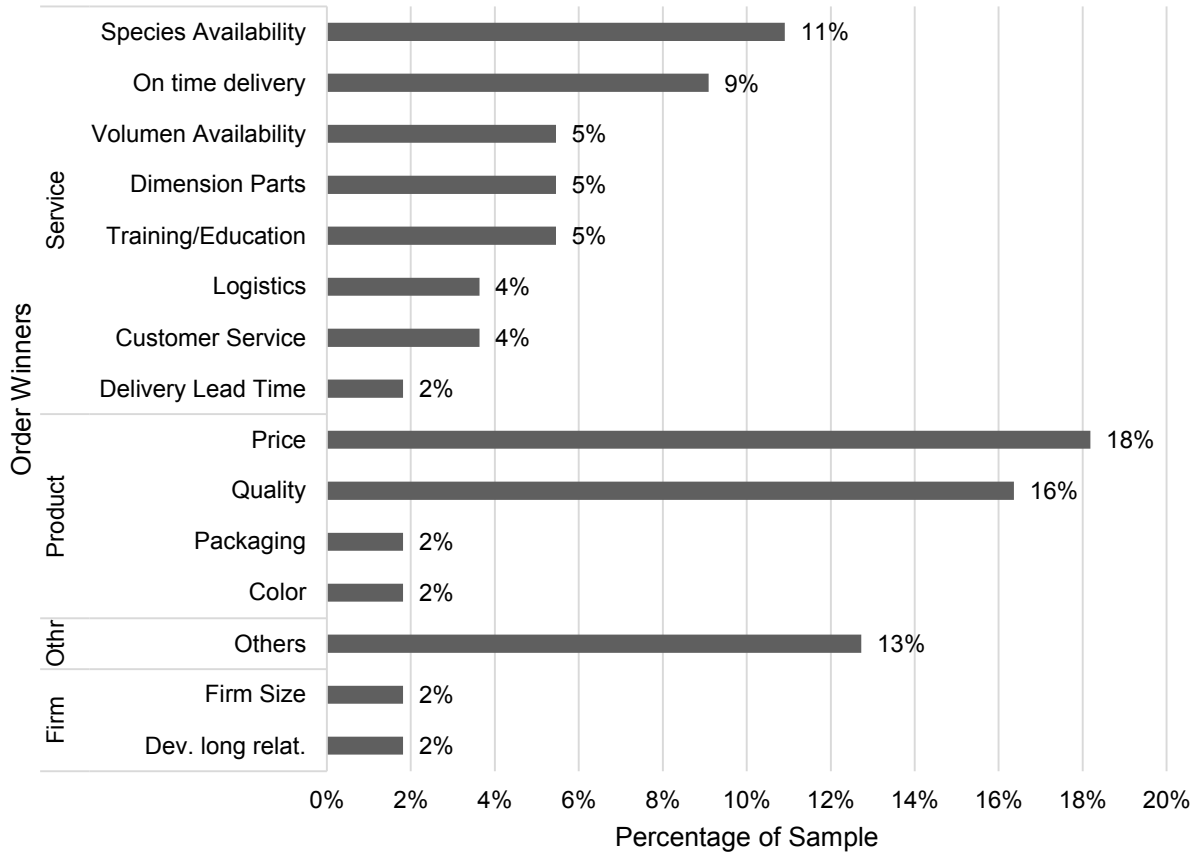
Figure 2.10 Question 9: Order Winners

Table 2.6 Question 9: Independence Tests

Independent Variable	Dependent Variable		Hypotheses
	Order Winner Category	Order Winner	
	Fisher's Exact Test	Fisher's Exact Test	
	P-Value	P-Value	
Respondent's Country	0.9575	0.9849	2-22 and 2-27
Respondent's Region	0.9884	0.9997	2-23 and 2-28
Supplier's Country	0.5851	0.4314	2-24 and 2-29
Product Species*	0.9471	0.9863	2-25 and 2-30
Product Types	0.9923	0.8472*	2-26 and 2-31

*Top five only

2.5   Discussion

The purpose of this case study is to explore the factors that drive the performance of hardwood firms in international markets. Previous research indicates that such factors may relate to the characteristics of the product, service, market, supplier, among others. By implementing a questionnaire with open-ended questions; the researchers allowed respondents to describe, in their own words, not only the main variables to be considered at the time of choosing hardwood products supplier, but those aspects where their expectations have not been consistently met, and where the opportunities for improvement lie. Following the argument offered in the literature review, the researchers have established a variable named *order qualifier*, to operationalize the minimum set of characteristics that customers perceive as necessary for a potential supplier (i.e. hardwood firm) to be considered for a purchase. Similarly, the variable *order winner*, account for those features that improve the supplier's position in the eye of customers. *Order qualifiers* and w*inners* were both categorized in *product characteristics, service characteristics, firm (supplier) characteristics, market characteristics, and others*.

Answers to question seven make it clear that product-related qualifiers, such as *quality*, *color* and *price*; become the main decision-drivers at the time of choosing a supplier for hardwood products. This category alone represents 65.08 percent of the total sample (Figure 2.11). Interestingly, when respondents are inquired about those elements of the business relationship where their suppliers are not meeting expectations, and where opportunities for improvement lie, there is a shift from *product* to *service characteristics*. Service-related qualifiers account for almost 47 percent of sample in question eight, whereby are found improvement in logistics, availability of species, delivery lead time, and certification as the main drivers (36 of total sample). Similarly, those

aspects that may set firms apart from competition, and which have been conceptualized as *order winners*, also relate to *service characteristics*. In question nine, this category represents 45.5 percent of responses, where *species availability*, *on-time delivery*, *volume availability*, *dimension sorting* and *training account* for the 35 percent of sample
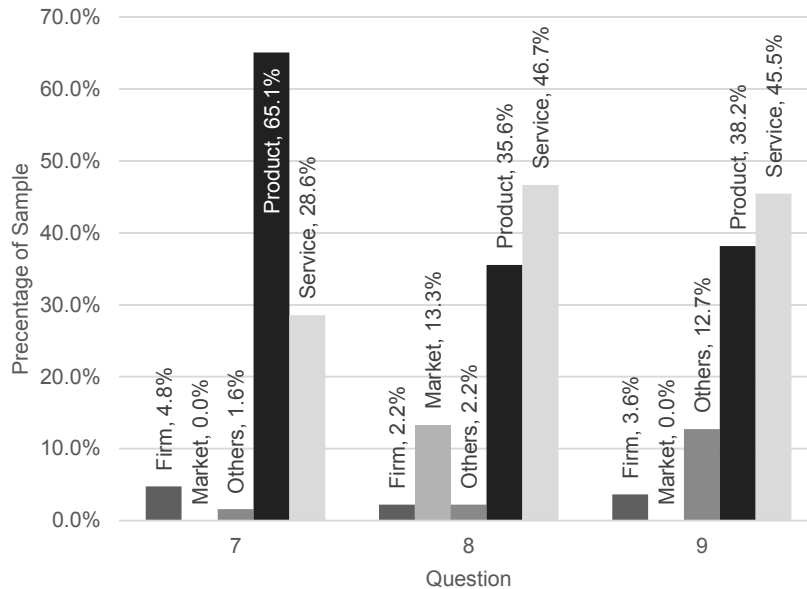
Figure 2.11 Comparison of Order Qualifier Categories: questions 7 to 9

Throughout the last three items of the questionnaire, *price* and *quality* remain as the top two factors. Moreover, *product characteristics* has consistently appear within the top two categories in this case study. Which indicates that any marketing strategy intended to address the international hardwood products markets should include such elements in its core; and include at the same time those aspects related service. The theory behind the concepts of *order qualifiers* and *order winners*, support the notion that certain characteristics of a firm's products and services would only permit former to enter the competition for customer's demand, and other features actually lead the company to create competitive advantage. To understand which aspects belong

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to one group or the other requires close examination of individual industries and markets for a specific period of time. What works for one industry may not necessarily help others. The differentiation between *order qualifiers* and *order winners* puts in perspective that, in the export markets for hardwood products, the central theme of any effort to achieve competitive advantage, requires focus on price and quality, but will also consist on carefully selecting the *service order qualifiers* and *winners* in which customers find the most value. The categorical data analysis performed to answers for questions one to six, revealed that sources hardwood products and species, are in fact related to the location of the supplier. In other words, different countries generally export different species and product types. However, the researchers did not find any relationship between the *order qualifiers* or *winners* previously discussed, and the location of firms interviewed, nor the location or suppliers, hardwood species and product types traded. It is interesting that although the data makes it explicit the existence of multiple types of *order qualifiers*, it does not reveal changes on their relevance from one market to another, as it has been proposed on previous research. Here is important to consider that measuring *export performance* is out of the scope of this exploratory study, therefore further research on these may reveal that although respondents may provide similar opinions about the relevance of *order qualifiers* in their respective markets, the actual performance may differ.

2.6   Conclusions

Exports have not come to raise the industry's total production levels to match 1999 records (12.9 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.

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 o*rder 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, regardless of the location of respondent. 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*, and *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.

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3 ADDING VALUE IN THE INTERNATIONAL HARDWOOD MARKET: THE U.S. EXPORTER'S PERSPECTIVE

Abstract

International markets have become critical for the U.S. hardwood companies to partially recover from past decade's crash of the housing market and the economic recession that followed. In order to maintain its presence, and ensure future growth in these markets, these firms need to make the most out of their resources, by putting in place the right business strategies to increase their competitive advantage in those markets. In a resource-constrained scenario, companies need to prioritize those plans, which will provide the greater returns; and in order to do so, guidance on markets' priorities are critical. This study explores the literature of international marketing and value chain analysis to identify generic drivers of *export performance* and competitiveness, and implements a survey in the U.S. hardwood lumber industry to determine the factors that matter the most for customers in Asia and Europe. Additionally, this study identified socio-cultural and political-regulatory aspects of the hardwood international markets, which need to be considered in any export strategy.

3.1 Introduction

3.1.1 Background

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 economy meltdown in the final quarter of 2008 (HMR, 2012). The housing starts 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 percent of the housing starts in 2005 (historical maximum), and 40 percent of the average of last 39 years. The Eastern US hardwood production, 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 minus 55 percent versus 1999 (Barford, 2012).

Exports haven't risen to match 2007 records, but they have certainly become a key market for present and short term US hardwood production. The international trade is expected to account for a 13.2 percent of the total industry revenue in 2014 (Goddard, 2014), thereby exports have become the second market in importance for the industry, only after pallets. The value of hardwood exports has increased from 1.89 billion USD in 2009 to 2.99 billion USD in 2013 – almost a 58 percent increase, which also signifies a 2.14 percent increase vs. 2006, the year that held the highest exporting record until now. The wood manufacturing industry is still far away s to match 1999 production records (14 BBF), so exports have certainly become a key market for short and long term growth (HMR, 2012). Hence, there is no question as to the growing importance of international markets, which have become a research priority. In view of previous research, the exports of hardwood products will be vital for the US hardwood industry to grow

The international markets of U.S. hardwood products consist of a significantly diverse mix of customers from different regions around the world; where Canada, Mexico, Asia and Western Europe have played a central role in developing the export industry. According to Food and Agriculture Organization of the United Nations (FAO), the United States accounted for almost 12 percent of the volume of non-coniferous sawed wood exported in 2012 worldwide, and 14.86

percent of its value (2.57 million cubic meters and 1.26 billion USD respectively), turning the country into the major supplier of this product category, value wise (FAO, 2014). The country also played a key role in the exports of non-coniferous round wood for the same year, accounting for of 604 million USD, which represented an approximate of 22.37 percent of total world exports (FAO, 2014). The American Hardwood Export Council also indicates (AHEC, 2011) that China, Germany and Italy led the world's wood furniture exports between 2008 and 2010, holding a 46% of total market, while United States only reported exports equivalent to a 2 percent of worldwide Exports throughout this time frame (9th place furniture exports). During the first decade of the 21st century, the US exports of hardwood products have characterized by a predominance of primary/low value added goods such as logs and lumbers, over other more complex and higher value added products such as furniture, molding, and flooring, among others.
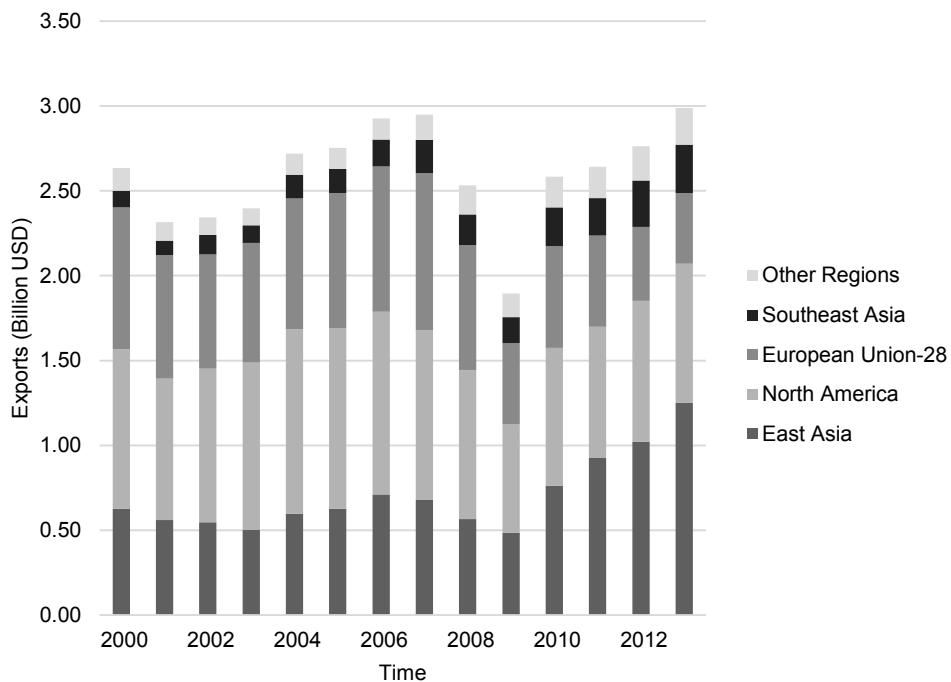
Figure 3.1 U.S. Hardwood Exports by Geographic Region 2000 – 2013 (FAS, 2014)

Figure 3.1 illustrates the total US Hardwood exports between 2000 and 2013 by geographic region. The export business represented approximately 2.99 billion USD in revenue for US Economy in 2013, evidencing a shift on the declining trend suffered by US hardwood producers since 2007, when exports reached the level of $2.9 billion and the fell to $1.9 billion in 2009 (FAS, 2014). Between 2010 and 2013, approximately 93 percent of U.S. hardwood exports concentrated in four main geographic regions: East Asia, North America (Canada and Mexico), the European Union, and Southeast Asia. The North American region, comprised by Canada and Mexico, accounted for 27.5 percent of total exports in 2013, while East Asia for 41.81 percent, and the European Union and Southeast Asia for 13.94 and 9.53 percent respectively. Other regions represented 7.21 percent of US hardwood exports for the same year (FAS, 2014). From a product category perspective, 81.30 percent of US hardwood exports in 2013, consisted in lumber and logs, whereas the remaining 18.70 percent corresponds to exports of veneers, flooring, and plywood, among others (FAS, 2014). Figure 3.2 depicts the exports of US hardwood products between 2000 and 2013, by product category.
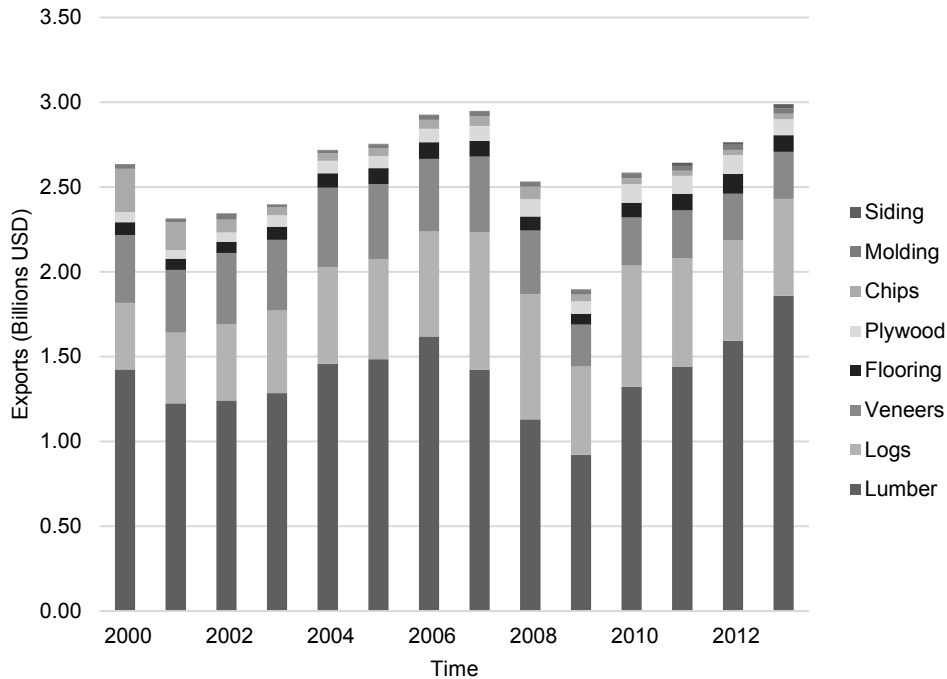
Figure 3.2 Exports U.S. Hardwood Products by Product Category 2000 – 2013 (FAS, 2014)

Between the years of 2000 and 2013 US hardwood products were exported to at least 177 countries around the world, whereas in 2013, Canada and China accounted for 57.45 percent of the same (36.18 and 21.27 percent respectively); also the third place was occupied by Vietnam with 6.57 percent, and other countries the remaining 17.39 percent.

3.2 Literature Review

3.2.1 Achieving high value in hardwood markets

Competitiveness is the capability of an organization to compete and outperform its rivals (OUP., 2009), by delivering greater value to customers, or offering similar at a lower price, or both (M. E. Porter, 1996). In order to develop such capabilities, business strategies need to be formulated

(Feurer & Chaharbaghi, 1994) to address the market's demand and the organization's shareholders expectations (Kaplan & Norton, 2000). The capabilities and competences possessed by an organization can meet the conditions, in the appropriate context, of "*becoming a source of sustainable competitive advantage*" (Collis, 1994). Such conditions are dictated by the resourced-based view of a firm. It argues that firms are essentially collections of resources, whose adequate utilization may permit above average profits (Bowman & Ambrosini, 2000).

In order to understand how the capabilities and competencies of a firm have a potential to deliver competitive advantage, the organization needs to be regarded as a collection of discrete activities, which are performed in alignment with its business strategies. In *Competitive Advantage* (Michael E. Porter, 1985), Porter presents the *Value chain* approach*,* as a means to systematically divide an organization into its "strategically relevant" activities, analyze their behavior and interaction, and determine their importance in the implementation of business strategies. The term *value* is utilized in this context to denote the potential of these activities to deliver the firm's value proposition (Kaplan & Norton, 2000). According to this model, value is created by operating a firm in such a way that the end product or service, has built-in features, for which the customers are willing to pay a price. Bowman et al. argue that, *value*, may actually take two forms: the *exchange value*, which correspond the model just explained; and the *perceived value*, which is subjectively determined by the customer (Bowman & Ambrosini, 2000). Under this paradigm, the value of the characteristics of products and services, varies from one context to another (e.g. by region or stage in the product life cycle). This variability in the value of a product or service, is addressed by Hill in his order winner/order qualifier framework (Hill, 2000). In accord with Hill's model, which was originated the field of manufacturing theory (Hofmann, Beck, Füger, & SpringerLink, 2013), the order qualifiers represent aspects of a product or service required for a customer to consider

buying it. The order winners on the other hand, consist in characteristics that position the product or service above those of the competition. Understanding the difference between these two concepts, and how they materialize in any given industry, is critical for an organization's strategic planning process. Therefore, understanding such aspects of the hardwood export business is one of the main themes of this research project.

The concepts of value chain, order winners and qualifiers, are based on the assumption that attaining competitive advantage depends on the organization's resources and *value chain*. However, previous research on international marketing indicates the existence of other factors related to the context in which firms operate, both locally and internationally. This field of study has coined the term "*export performance*" to address the factors that determine the success of a firm in achieving its objectives in international markets. Which for the purpose of this study, will be considered as synonym of international competitiveness and will be discussed in the following section.

3.2.2   Export Performance

Previous research on *export performance* indicates that in general, achieving competitive advantage in international markets depends on the characteristics of the firm, its marketing strategies, the characteristics of the target markets, and certain aspects of the domestic context, such as the support offered by government and trade associations for the development of businesses abroad (Leonidou, Katsikeas, & Samiee, 2002; Shaoming & Simona, 1998; Sousa, Martínez-López, & Coelho, 2008). Models have been formulated to explain *export performance* according to the competitive intensity and technological turbulence (Cadogan, Cui, & Li, 2003), management style (Aaby & Slater, 1989), export market orientation (Cadogan, Diamantopoulos,

& De Mortanges, 1999), among others. A meta-analysis of the *export performance* literature conducted in 2008 (Sousa & Martínez-López, 2008), revealed that for the research published between 1998 and 2005, 27 percent focused on *product strategy* as explanatory variable, 38 percent on *firm size*, 19 percent on management commitment and support to export, etc.

3.2.3 Previous research in the hardwood business

The review of the literature of export performance was performed in accordance with the key concepts established in previous sections, and is depicted by Table 3.1. An initial set of thirty-five references that met some of the keywords were selected for the study. The articles focused only on industry statistics were removed from the sample, leaving a final set of twenty-one documents, among peer-reviewed papers, books and theses and dissertations. The oldest reference was published in 1991, and the most recent in 2013. A summary of key aspects found in the literature, along with a complete list of the material visited (Table 3.2), are presented in this section.

Table 3.1 Concept Table: International Value Chain of Hardwood Products

Categories	Concepts					
	Exports	& Hardwood	& Products	& Secondary	& Asia	& Europe
Keywords	Exports	Hardwood	Products	Secondary	Asia	Europe
	Market			Value added		EU
				Primary		
Synonyms	Shipments		Goods	Higher value	Far East	
	Trade, International Trade		Merchandize	Transformation		
	Sales, International Sales					
Related Terms	Value Chain	Forest Product			China	
	Supply Chain	Wood			India	
		Timber			Vietnam	
					Thailand	

Bush and Sinclair (Bush & Sinclair, 1991), conducted a study to classify one hundred of the largest U.S. hardwood lumber producers, according to Porter's (Michael E. Porter, 1985) three generic strategies: differentiation, focus and cost leadership. Their results suggest that larger firms at that time, were moving away from traditional cost- and production-oriented strategies towards product differentiation, in order to achieve competitive advantage in domestic markets. Armstrong et al. (Armstrong, Ponzurick, & Luppold, 1993) studied the characteristics of the Canadian market for U.S. hardwood lumber in the summer of 1991. A mail survey was conducted in 220 firms, which suggested that most of the demand came from flooring, molding and millwork manufacturers, at the metropolitan Toronto area and the St. Lawrence River valley of Quebec. Ifju et al. (P. Ifju & Bush, 1993) surveyed 354 small hardwood lumber companies in the eastern U.S. to identify inhibitors and catalyzers to participate in export markets. They found that lack of information is the major roadblock to exporting. This information involves aspects such as: markets, distribution channels and product requirements. The perspective of increasing profit, and the opportunity to find support in export distributors-brokers appeared as the major driving export factor. Likewise, a study conducted by Dickerson and Stevens in 1998 for Michigan hardwood lumber companies, found that "self-rated" knowledge on export markets was associated with firms more active in these markets. Idassi et al. (Idassi, Young, Winistorfer, Ostermeier, & Woodruff, 1994) conducted a gap analysis between a southern hardwood lumber company and 14 of its customers, to test discrepancies or gaps in expectations between producer and customers. Personal interviews were carried out with the firm's executives, and a mail survey for its customers. This study indicates that at least 10 non-product related attributes were important in creating value, from the customer's perspective. The top five of these attributes were found to be service-related: *accurate communication*, *personal relationship*, *supplier's reputation*, *promptness of delivery*, and

competitive pricing. Also in 1994, Ifju and Bush published their study on the export assistance in the hardwood lumber industry (P. A. Ifju & Bush, 1994). They studied 354 firms located in all states east of the Mississippi river and those at the west border of the same. Their sample consisted of with 35 employees or less. This work suggests that 70 percent or respondents were aware of the services provided by export assistance and promotion programs. It also proposes that the most popular service used by exporters involves providing contact with more experienced firms. The available literature on sources of competitiveness for secondary wood product firms was studied by Hoff et al. in 1997 (Hoff, Fisher, Miller, & Webb, 1997). They found that in order to improve their performance in international markets, U.S. firms need to be able to assess their relative competitive position in the market, and understand how to influence their strategic determinants. According to Hoff, previous research indicates that such determinants correspond to the following: the firm's processes, external market and government policy.

A survey study conducted by Smith in 2002 (Smith, 2002), addressed the relationship between value, as perceived by customers, and the following factors: product, service, and price (relative to that of the competition). The non-statistical sample consisted of 460 U.S. purchasers of hardwoods, which were selected from a list of customers and prospects of two lumber production firms located in the upper Midwest of the United States (the total usable responses were 110). This research pointed some difficulties in differentiating from "important" attributes and "value added" attributes. For instance, consistent thinness and competitive price were found to be the most important attributes, but they proved to be of little help in influencing the customers' value perception of the supplier. Conversely, the study highlighted that service-related attributes, such as species availability, were the most critical elements in improving customer value. In 2008, Bowe et al. studied the prospects and roadblocks associated with exporting wood exports to China

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(Bowe, Bumgardner, & Mace, 2008). This study revised the trends in exports to China, and the opportunities and challenges for producers of primary and secondary woods products separately. The data collection for the primary producers took place through a survey and on-site interviews. The sample consisted in 45 Chinese firms, out of which 30 thirty percent were furniture manufactures, 26 percent lumber brokers, flooring manufacturers accounted for 12 percent, wood markets for 12, and others for the remaining 21 percent. Authors tentatively concluded (due to the small sample size) that the United States faces competition from Russia, Brazil and Southeast Asian countries, in Chinese markets. They also suggest that the following factors to grow in China: using brokers, developing contacts with the local wood market, investing in market research, and developing selling arrangements. Hammett et al. (A. Hammett, Naka, & Parsons, 2009) conducted two surveys (1989 and 2002) to examine the change in the characteristics of twenty-six Appalachian hardwood lumber export firms. They found that within a 13-year time period, these companies grew considerably in terms of number of employees, annual production and salespeople assigned to international accounts. It was also found that exporting firms moved from selling their products through brokers, to direct sales; and that the customer base became larger and more diverse, in order to adapt to the current market conditions. In 1992, Hammett conducted a study that involved surveying nine hundred hardwood lumber manufacturers in the southern United States (A. L. Hammett, Cubbage, & Luppold, 1992). In this study, logistical regression was utilized to model the relationship between firms' characteristics, and their participation in export markets. The results suggest that export participation is positively influenced by: production levels, the oak species produced, access to marketing knowledge, covered storage capacity and the education level of the sales manager. Parhizkar studied the transportation and competitiveness practices of U.S. hardwood lumber exporters in Mexico, Asia and Europe (Parhizkar, 2008). In

his study, a logistical regression of survey data was used to determine the factors that increased the firm's involvement in international markets. It was found that certain transportations modes, hardwood species, marketing practices, and taking advantage of the government assistance programs had a positive effect in developing a high involvement in export markets. Lyon et al. investigated the opportunities for Appalachian forest products firm to export to Central America, with a focus on marketing practices (Scott W Lyon, Quesada-Pineda, Smith, & Kline, 2013). This study suggested that lack of efforts and investment on marketing activities, inhibited growth in those markets.

Table 3.2 Literature Review: Harwood Business

Ref	Year	Author	Title	Themes
1	1991	(Bush & Sinclair, 1991)	A Multivariate Model and Analysis of Competitive Strategy in the U.S. Hardwood Lumber Industry	Strategic groups
2	1992	(A. L. Hammett et al., 1992)	A Logistical Regression-model of Southern Hardwood Lumber Export Participation	Exports Behavior Logistical regression
3	1993	(Armstrong et al., 1993)	U.S. Hardwood Lumber Exports To Canada: An Assessment Of Market Segments	Export Statistical data Market segments Lumber industry
4	1993	(P. Ifju & Bush, 1993)	Export Barriers and Incentives in the Eastern Hardwood Lumber Industry	Lumber industry Exports Advantage
5	1994	(Idassi et al., 1994)	A Customer-oriented Marketing Method for Hardwood Lumber Companies	Market strategy Lumber industry
6	1994	(P. A. Ifju & Bush, 1994)	Export assistance in the hardwood lumber industry: An examination of awareness, use, and perceived benefit	Export Assistance
7	1997	(Hoff et al., 1997)	Sources of Competitiveness for Secondary Wood Products Firms: A Review of Literature and Research Issues	Advantage Furniture industry Globalization Hardwood Lumber
8	1998	(Dickerson & Stevens, 1998)	Marketing Characteristics of Michigan Hardwood Products Exporters	Marketing Exporters
9	2002	(Smith, 2002)	Exploring Customer Value in the Hardwood Lumber Industry	Customer Value Hardwood Lumber Marketing Logistic Regression
10	2003	(Parsons, 2003)	An examination of Appalachian forest products exports	International marketing Exports
11	2006	(Grushecky, Buehlmann, Schuler, Luppold, & Cesa, 2006)	Decline In the U.S. Furniture Industry: A Case Study of the Impacts to the Hardwood Lumber Supply Chain	Furniture industry hardwood markets

Ref	Year	Author	Title	Themes
12	2007	(Buehlmann, Bumgardner, Schuler, & Barford, 2007)	Assessing the impacts of global competition on the Appalachian hardwood industry	Forest products industry Sawmills Impact analysis Globalization Competition
13	2008	(Bowe et al., 2008)	Opportunities and Challenges for the Export of U.S. Value-added Wood Products to China	Exports Value added
14	2008	(Brodrechtova, 2008)	Determinants of Export Marketing Strategies of Forest Products Companies In the Context of Transition: the Case of Slovakia	Marketing strategy Export
15	2008	(Parhizkar, 2008)	Identifying Impact Factors on Successful Exporting of the United States Hardwood Industries to Mexico, Asia, and Europe	Export Performance Logistics Competitiveness
16	2009	(A. Hammett et al., 2009)	Changes in Appalachian Hardwood Lumber Exporter Practices, 1989-2002	Exports Marketing
17	2009	(Naka, Parsons, & Hammett, 2009)	Hardwood Lumber Industry in The Appalachian Region: Focus on Exports	Lumber export
18	2010	(Wang, Wu, DeVallance, & Armstrong, 2010)	Appalachian Hardwood Product Exports: An Analysis of the Current Chinese Market	Studies Wood products US exports Trade barriers Recessions
19	2010	(Parhizkar, Miller, & Smith, 2010)	Private Sector Development Implications of the Export Performance Determinants of U.S. Small–medium Forest Enterprises to Mexico, Europe, and Asia	Export Performance Logistics Competitiveness
20	2011	(Scott William Lyon, 2011)	Breaking Down Barriers: Market Opportunities for Appalachian Forest Products in Central America	International marketing
21	2013	(Scott W Lyon et al., 2013)	Identifying Market Opportunities for Appalachian Forest Products Companies in Central America	International marketing

3.2.4   Theoretical Framework

In a recent strategy focus meeting organized by the Hardwood Market Review in Charlotte, NC (HPC, 2010): Hardwood companies & associations expressed their concern about the need of quality marketing research to better understand and address the factors affecting the value chain of hardwoods in international markets. According to previous research, it may take at least ten years for the United States to the same levels of housing starts observed before the economic recession of the past decade, therefore the international markets remain critical to sustain and growth the hardwood industry. To stay competitive in these markets, companies need to identify and understand the factors that lead to competitive advantage for hardwood products, so that adequate strategies and tactics may be formulated. The purpose of this research is to identify those

factors, and enable U.S. hardwood companies to formulate business strategies to gain competitive advantage, by increasing the value of their products and services. Figure 3.3 depicts the export performance factors found in the literature. These factors were incorporated into the theoretical framework as the basis for the research design. This design will be addressed in the next section.
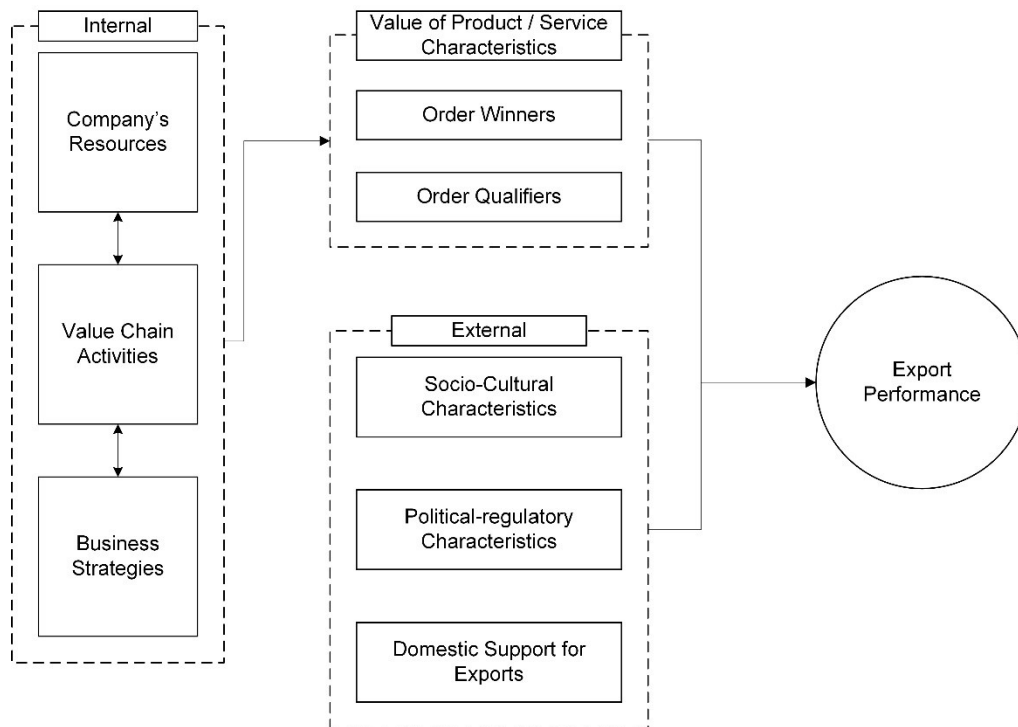
Figure 3.3 Theoretical Framework: Phase 2

3.3   Methodology

3.3.1   Overview of Research Design

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 (Figure 3.4). For this purpose, the researchers designed an on-line questionnaire consisting of seven 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 one 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 utilized for this survey has been included in appendix Appendix A.

The questionnaire was designed, pre-tested and implemented following the "Tailored Design Method" proposed by Dillman et al. (Dillman, Smyth, & Christian, 2009b). The selection of the survey platform was based on the consideration of 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 thirty-five questions was designed to address the three main areas previously described, which include open-ended and closed-ended questions, most of them categorical. The distribution of the same took place through the National Hardwood Lumber Association (NHLA) electronic newsletter, in three

separate issues: one initial request, 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 variable and the potential relationships among them. This 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.
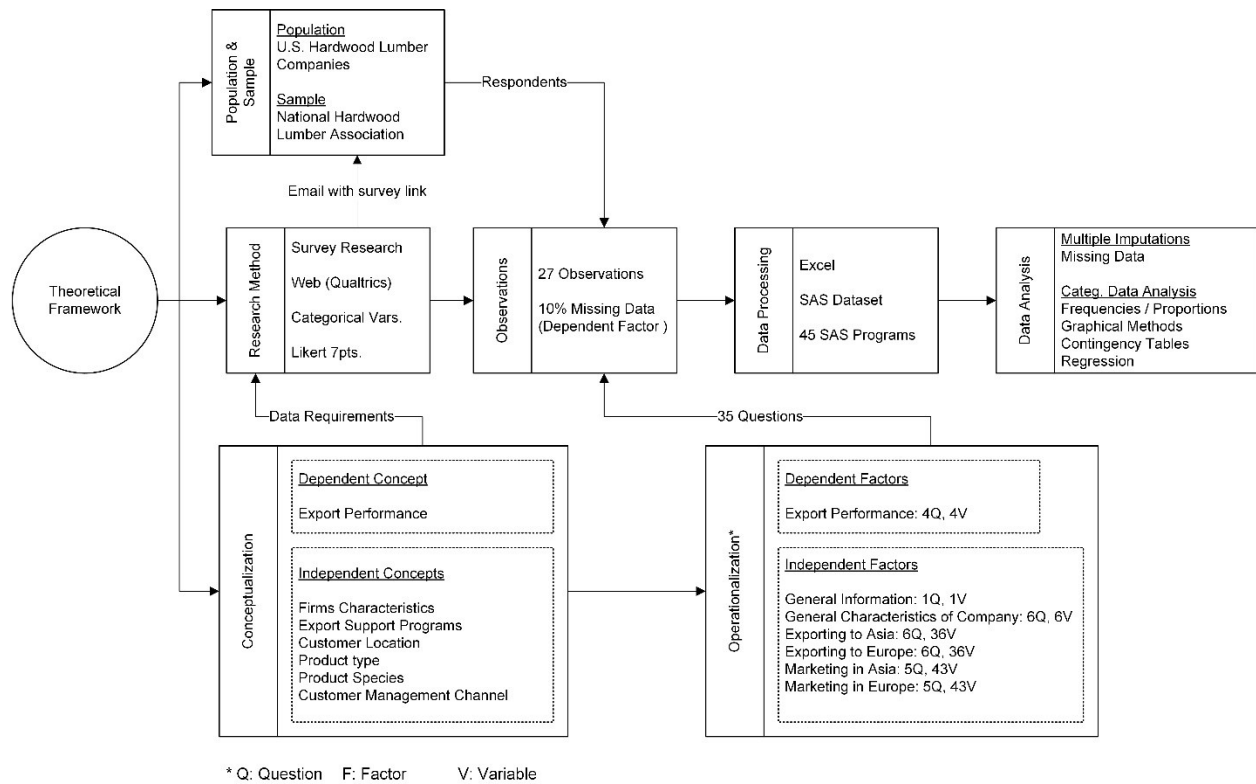
Figure 3.4 Research Design: Phase 2

3.3.2   Research Method: Survey

Survey research is an observational study mode in the social sciences that gathers information from

respondents through the application of a questionnaire, with the purpose of making inferences

about the population respondents belong to (Babbie, 2010). This method is usually preferred when

the unit of analysis is the individual person; however, it is also widely used for studies that involve

groups or organizations, such as markets or companies. Surveys are observational rather than experimental because their intent is to capture information without influencing the unit of analysis. Survey research is an effective way to collect data because the observation can be carried out indirectly - the researcher does not need to be physically with the respondents; instead, it may be self-administered. Additionally, only a sample of the total population can be observed to make inferences about the whole, as long as the sample is randomly selected. It is considered as a quantitative method: its purpose is to make inferences about the population the respondents belong to. Here, the respondent is the individual person that provides data by answering the survey questionnaire.

3.3.2.1 Goals of Survey Research

Survey researchers may have one or multiple goals to conduct a study. According to the nature of these goals, studies can be classified as exploratory, descriptive, explanatory or a combination of these. Exploratory studies are conducted when the researcher is interested in increasing his understanding of the relevance of a topic to a given population, or to assess the feasibility of conducting a larger study. Descriptive surveys are designed to describe the characteristics and behaviors of the population. Explanatory surveys are carried out when there is an interest in understanding why things happen (Vaske, 2008). In order to achieve this objectives, survey researchers generally need to complete following phases:

1. Specifying the research questions and hypothesis
2. Design the survey and the implementation plan (i.e. survey methodology)
3. Collect and analyze data

3.3.2.2   Specifying the research questions and hypothesis

Survey research, as many other types of research starts with the definition of a problem. Once a problem statement has been clearly defined, it is the work of the researcher to look for theories that explain, in general terms, the phenomenon studied. With some background knowledge of previous research work and the theory developed on the subject, the researcher establishes a set of hypotheses for the problem - testable expectations on how the phenomenon of interest works according to theory. The research questions (Alford, 1998) are similar to hypothesis but are formulated in a question format. The purpose of research questions is help with the design of a research that will build an argument based on theory and experimental data, and make inferences about the nature of the phenomenon of interest. With all this knowledge at hand, the researcher should be able to create a theoretical framework to guide the design our survey.

3.3.2.3   Design the survey and the implementation plan (i.e. survey methodology)

Designing a survey involves crafting questions that will help the researcher with measuring the relation between variables as stated in the theoretical framework and or describing the situation being studied (Dillman, Smyth, & Christian, 2009a). Dillman et al. (2009) indicate that there is a difference between a list of questions and survey questionnaire. In the process of answering a survey, respondents extract information not only from the wording of questions, but from the order in which they are arranged, the symbols and spaces provided to enter the responses, the colors used, the headings of sections, the scales, the typography, and in general, of the visual design. In this context, a list of questions if the first step in designing a survey, but not the only one. To craft

survey questions, the researcher needs to decide what format is the most appropriate to collect the information he or she is looking for. At this point it is important to realize that questionnaires are not only collections of questions, but also of statements upon which respondents are asked whether they agree or disagree. Indexes and scales have been developed to measure the degree of approval, importance, frequency, etc. (e.g. Likert's Index). When designing questions, researchers may follow two different approaches: open-ended or close ended questions. Open-ended questions allow the respondents to provide their own answers, whereas in close-ended questions the responded is asked to choose his or her answers for a list of alternatives. Open-ended questions area ideal to ask in-depth information about the topic of the question, but other (less descriptive) alternatives of open-ended questions are also used to ask for numerical values or for lists of items. The answers to open-ended questions need to be coded so that quantitative techniques can be used for the analysis. Closed-ended questions can be divided in two categories: nominal and ordinal. Nominal close-ended questions provide the respondent with a list of alternatives that don't follow any natural ordering, whereas ordinal close-ended do. Both categories may be single or multiple answer (Babbie, 2010).

In order to migrate from a "list of questions" to a questionnaire, three fundamental aspects of design need to be addressed: technology, ordering and visual design. The most common technologies used currently in survey design are mail survey, on-line survey and phone-survey. Each one of these categories presents its variations and implementation challenges, the selection of the technology dependents largely depends on the feasibility to reach all members of population sample (Dillman et al., 2009a). Additionally of the technology, the questionnaire should be organized similar to a conversation, in accordance with societal norms (Dillman et al., 2009a). In general, conversations follow a logical order where general questions that apply to nearly all

respondents go first; those asking for sensitive information a left for the end, and the main body of questions is grouped together by topic.

When respondents begin to answer a questionnaire, they are also learning how it works. In general, the way people process visual information can be divided in into three stages. First comes the understanding of the general layout of the page or screen, then the individual begins understands the way information is organized within the layout, and finally the individual's attention is focused on the task at hand - answering the questions. There are multiple aspects of the visual design of a questionnaire that can be manipulated to make it more friendly and professional, in such a way that increases the response rate; but what is key is to establish consistency in the visual presentation of questions across pages and screens, so that respondents won't need to re-learn how to the questionnaire works multiple times. Implementing a survey involves more than just sending the questionnaire, it also requires looking for tactics to motivate the respondents to see the potential value of the research project and participate. Developing a proper communication strategy is key to engage participants in the project. For the mail survey, Dillman recommends a five steps process that involves: a) pre-notice letter, b) questionnaire mailing (with cover letter), c) thank you post card, d) replacement questionnaire and e) a final contact notice. A similar strategy can be develop for other survey modes.

3.3.2.4 *Web survey implementation*

The process of implementing a Web survey, encompasses the same activities just cited for mail survey. However, one major difference between mail and Web implementations is that, in principle, the mail survey is delivered to the respondents, whereas for a Web survey, respondents are asked to access the it, which fore some may be an easy task, but for others, it becomes an uncomfortable task (Dillman et al., 2009b). Therefore, making this task as simple and

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straightforward as possible, is critical. Two advantages of the Web survey of the mail, are time and cost. Web survey reduces drastically the time required to reach a population, and eliminates the expenses related to printing and mailing a questionnaire. (Wright, 2005). This survey mode, unfortunately, presents some disadvantages not found in mail. For instance, email lists for target population, may not be public, accurate, or may not exist at all. Even when such lists exist, and are available to the researchers, careful examination may be required to ensure records are accurate and do not double-count respondents (Wright, 2005). Accessing respondents via email may also represent a challenge for researchers. Emails can be considered *spam*, and not be read by respondents. Some respondents may consider that being approach by email is rather rude, and be offended by such. For these reasons, it is recommended to look for support or sponsorship from an organization considered to be trustworthy by the target population (Dillman et al., 2009b).

3.3.2.5   Collect and analyze data

Once the responses have been received, the researchers need to learn from the data to increase his or her understanding about the sample and the population; that is why statistics are used. There are two main areas of statistical analysis that can be performed on the data: descriptive and inferential. Descriptive statistics are used to determine the characteristics of the sample and relationship between variables within the sample, whereas inferential statistics address the study of the characteristics of the population and the relation of variables at such level. There are multiple statistical procedures for making inferences either to single or multiple variables, Figure 3.5 provides an overview of them.
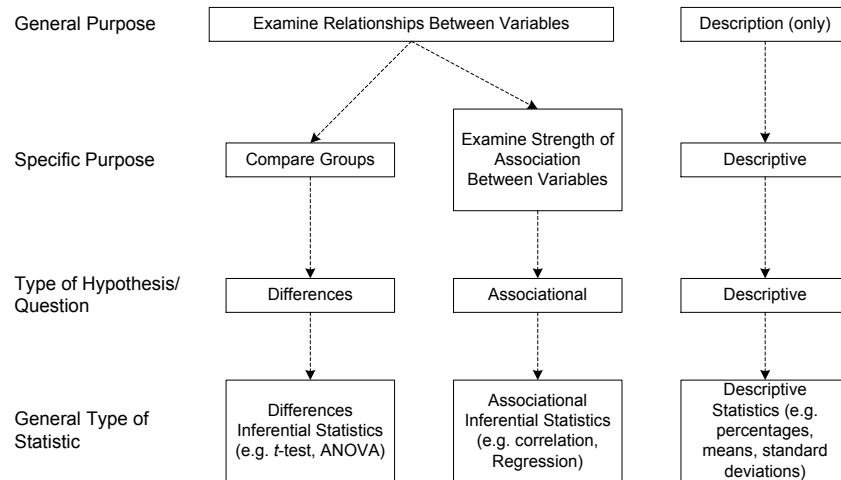
Figure 3.5 Relationship between Purpose of Research and Appropriate Statistics

Survey research is a valuable tool in business since it provides with information about organizations and their contexts to make better decisions. It is important to understand that multiple aspects of the design and implementation of a survey have a posterior impact on the quality of the data. Therefore, careful study of the different phases involved in the process is an important area of concern for researchers.

3.3.3 Data Analysis

3.3.3.1 Categorical Data Analysis (CDA)

In categorical data analysis, the study of a single variable, can be performed by counting the number observations in each category, and then calculating the proportions for the sample, to infer the category probabilities (Agresti, 2007; Cody, 2011; Stokes, Davis, & Koch, 2012). When multiple variables are analyzed simultaneously, it is said that they form a multidimensional contingency table where each variable corresponds to 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-square test of independence, which validity has been accepted for cells with large number 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).

3.3.3.2 Reliability Assessment

In social science research methods, a measurement is the process of linking an abstract concept to an empirical indicant (variable). In order to determine if the measurement yields the same results on repeated trials, a reliability assessment is needed (Carmines & Zeller, 1979). There are multiple approaches available in the literature, but the most popular is the Cronbach's Alpha (Cronbach & Meehl, 1955), which was used in this study.

3.3.3.3 Multiple Imputations for no response in surveys

Multiple imputation is a statistical technique used to manipulate missing data (Rubin, 2009). This approach consist in replacing the missing values with two or more imputed values that follow a certain probability distribution. This distribution is determined from the observed data (Carpenter & Kenward, 2012). To implement this technique, the Multiple Imputation and analysis procedures (PROC MI and PROC MIAnalyze) in the Statistical Analysis Software SAS© (SAS Institute Inc., 2014a, 2014b), were utilized (Berglund, 2010; Yuan, 2010).

3.4 Results

3.4.1 Overview

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 (i.e. incomplete items). Which represents less than 3 percent 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. In order to deal with such a small sample, two considerations were made in the analysis. First, Chi-square test for testing association of variables in contingency tables in not reliable for small samples, therefore Fisher's exact text need to be used instead (Agresti, 2002). Second, to address the nonresponses, multiple imputations (Rubin, 2009) were implemented to generate substitute missing data. This task was performed in the statistical software SAS, by means of four procedures: PROC MI to generate the imputations, PROC SURVEYFREQ to perform the contingency table analysis, PROC GENMOD to run the regression analysis, and PROC MIANALYZE to account for the penalization in variability due to the imputed data.

3.4.2 General Characteristics of the Companies

The first item of the survey asks whether the respondent's firm exports hardwood lumber or not. Approximately 85 percent of the sample confirmed to be involved in international trade of hardwood lumber, while the remaining 15 percent of respondents are not currently exporting. On 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

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employees, and those bigger in size have a workforce of about 500 employees. At least two firms were found not to have any employees dedicated to sales and marketing activities, and approximately 27.27 percent of sample has 2 employees in this category. When inquired about the number of sawmills currently in operation, 45.45 percent of the sample confirmed to possess only one, while 27.27 percent indicated not to be directly involved in lumber production (i.e. distribution, commercialization only), whereas one firm (9.09 percent) acknowledged to own ten sawmills. The domestic sales for 2012 seem to be mostly distributed between 5 and 40 million USD (Figure 3.6): 87.50 percent of responding firms reported within this range, and 12.50 percent of the same stated export sales above 50 million USD.
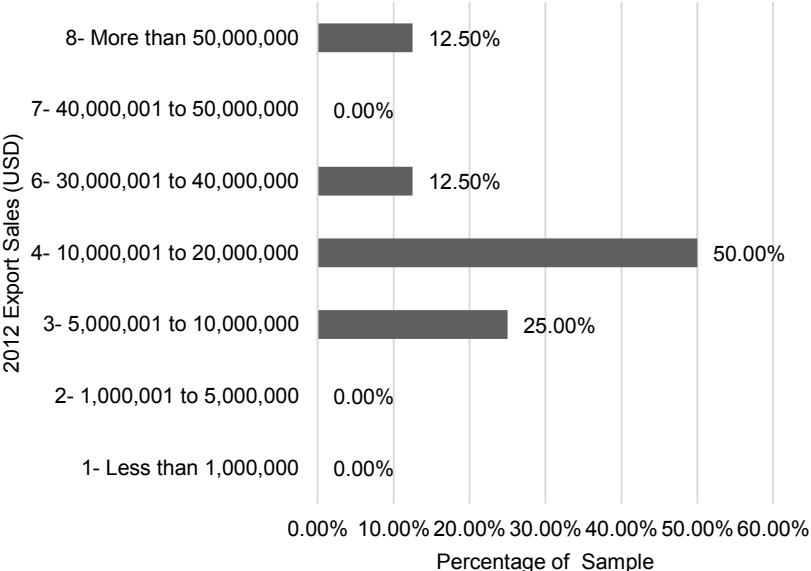
Figure 3.6 Distribution of Respondents by Exports Sales

3.4.3 Exporting to Asia

3.4.3.1 Market Characteristics

The sample included in this study consisted in 88.24 percent of firms currently exporting to Asia, and 11.76 percent of non-exporters. In 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 newest entries for 4 years. Figure 3.7 depicts the approximate distribution of exports per country. China and Vietnam together account for 91.45 percent of the exports to Asia, whereas Indonesia represents 3.72 percent, and other countries the remaining 4.82 percent. The majority of the U.S. hardwood lumber imported to these countries is consumed by the furniture industry (43 percent), 27.5 percent goes to flooring manufacturing firms, and the remaining 30 percent is distributed among mill work, cabinets, pallets and other sectors. In 32 percent of the instances, the Asian firms acquire the U.S. hardwood lumber they need from wholesalers in Asia, whereas in 28 percent of the time, firms contact the U.S. suppliers directly, or a wholesaler in the U.S. (24 percent). It was also found that in 12 percent of the case, the lumber is distributed through U.S. firms' own affiliates located in Asia, or other channels (remaining 4%). Finally, it was found that 33.5 percent of firms in this study export red oak, 32.7 percent exports yellow poplar, and 20.00 percent white oak.
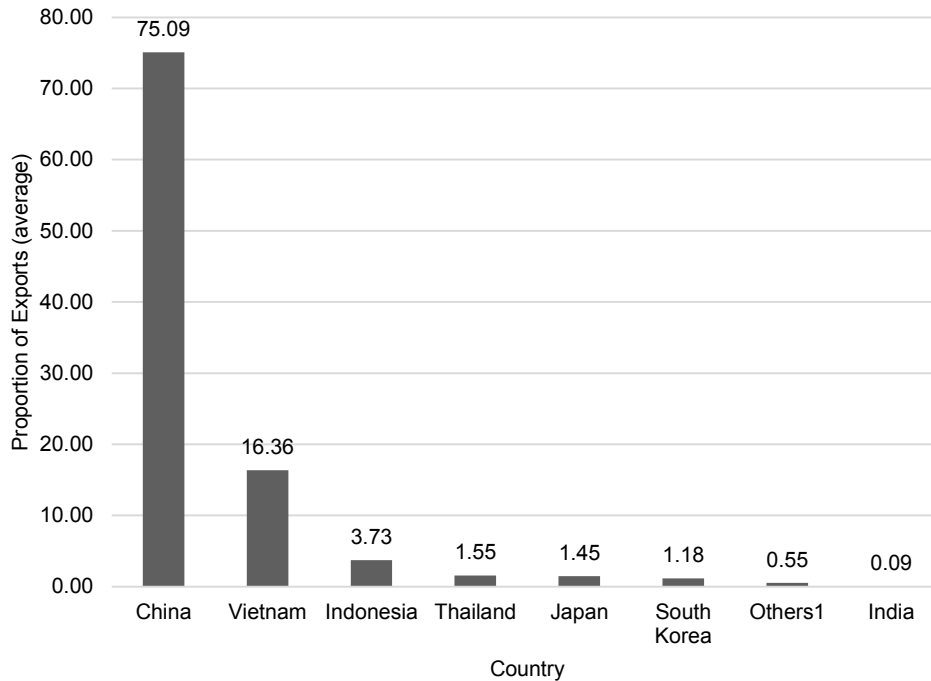
Figure 3.7 Distribution of Exports of U.S. Hardwood Lumber to Asia (averages)

3.4.3.2   Export Strategies

Firms involved in this study, were inquired about their strategic plans for long term growth and increase profitability in Asia, as well as the importance of specific tactics to improve competitiveness, market positioning, and hence *export performance* in this region. Figure 3.8 depicts the relative importance of proposed marketing strategies for growth in Asia. At least 10 percent of the sample consider that improving their pricing policies are necessary to ensure future growth in this region, whereas 20 percent believes in introducing new product features, and 30 percent in increasing promotion and advertisement (P&A). The "*others*" category, which accounts for 40 percent of the sample, includes 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 3.9.   In contrast to the "*growth strategies*", *improving*

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prices is considered by 28 percent of the sample to be critical for increasing the lucrativeness of exports to Asia. In a similar fashion, 29 percent of responses indicate that increase productivity for this goal. Other strategies found to be also important were *reducing manufacturing* and *transportation costs* (19 and 14 percent respectively). The remaining 10 percent of responses include *reducing P&A* costs and others.
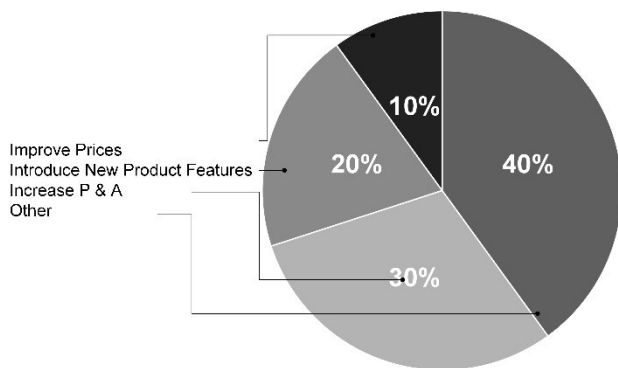
Figure 3.8 Respondent's Plans for Growth in Asia
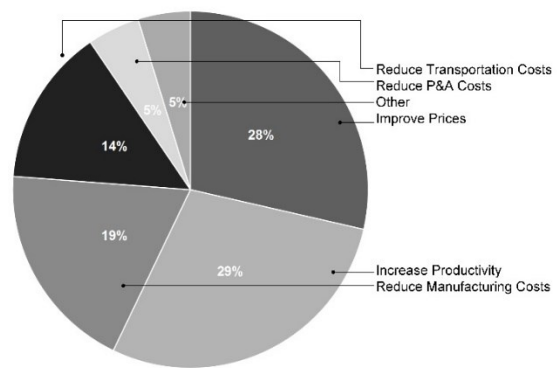
Figure 3.9 Respondent's Plans for Profitability in Asia

The results of question eleven, which measured the relevance of *export performance* factors found in literature review for Asian markets, are depicted in Figure 3.10. This measurement was conducted using a Likert scale of seven items (Jamieson, 2004), which is condensed into a three-items scale for simplicity of reporting. It was intended to quantify the importance of sixteen 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 questions eleven is found to be grouped in two main o*rder winner* categories: *product characteristics* and *service characteristics*, according to the concepts of *export*

performance studied in the literature review. The top four individual order winners in Asia are*: Quality, Packaging, Volume Availability* and *Customer Service*, being the first two product related, and the other four service related.
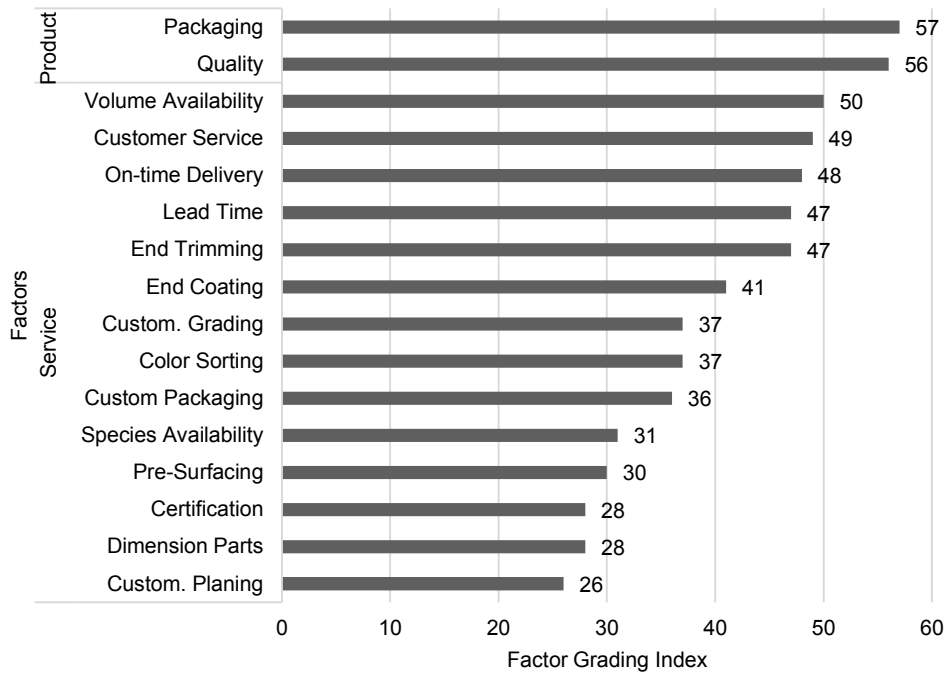
Figure 3.10 *Export performance* Factors (Drivers) in Asian Markets

The last two sets of variables evaluated in this section of the questionnaire address social, cultural, political and regulatory characteristics of the export markets themselves. The social and cultural factors' relative percentages are presented in Table 3.3. The three top factors found in the "*important*" category are *Business Ethics*, Language and *Values/Beliefs/Attitudes*, which relative percentages are 89, 67 and 67 respectively. The respondent firms remained more neutral about factors such as the *Education Level* and *Religion*, (0.63 and 0.67 percent respectively) and did not present any significant percentage in the "*Not Important*" category of the socio-cultural factors.

Table 3.3 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	0.11	0.89	1.00
Customs and traditions	0.22	0.33	0.44	1.00
Education level	0.00	0.63	0.38	1.00
Language	0.11	0.22	0.67	1.00
Religion	0.22	0.67	0.11	1.00
Values, beliefs, attitudes	0.11	0.22	0.67	1.00

Similarly to socio-cultural factors, respondents did not seem to consider any of the political and regulatory factors unimportant, only 3.75 percent of the responses fell within this category. On the other hand, 27.50 percent of the respondents remained neutral about the effects these factors may have on *export performance*. Particularly, *International Association* of export markets, show relative a percentage of 67 in the *neutral* category.

Most of interviewed firms' responses fall in the *important* category. Factors related to foreign government's attitudes and policies towards U.S. firms lead this category with equal percentages of 10 each; followed by *political stability*, *regulatory system*, *bureaucracy* and *business protection*: with 88, 78, 67 and 67 respectively. The results of this question are presented in Table 3.4.

Table 3.4 Importance of Political-Regulatory Characteristics of Asian Markets Respondent's *Export performance*

Factor	1- Not Important	2- Neutral	3- Important	Total
Bureaucracy	0.00	0.33	0.67	1.00
Business Protection	0.00	0.33	0.67	1.00
Gov. Foreign Policies	0.11	0.33	0.56	1.00
Gov. Attitude to Foreign Business	0.00	0.11	0.89	1.00
Gov. Controls/protectionism	0.00	0.11	0.89	1.00
International Association	0.11	0.67	0.22	1.00
Political System	0.11	0.22	0.67	1.00
Political stability	0.00	0.13	0.88	1.00
Regulatory System	0.00	0.22	0.78	1.00

3.4.4 Exporting to Europe

3.4.4.1 Market Characteristics

It was found that 72.73 percent of the sample is currently exporting hardwood lumber to European countries. In average, interviewed firms have been in this market for around twenty-eight years. It was also determined that the firm with least experience, started exporting to Europe 10 years ago, and that with more time dealing, forty-four years. The biggest market for interviewed firms is the United Kingdom (Figure 3.11), which represents 24 percent of exports, followed by Spain, Italy and Germany with 22.86, 20.00, and 17.86 percent of the same, respectively. Other markets account for 15 percent of exports coming from sample. Approximately 37.86 percent of the lumber exported by these firms to Europe, is used in the mill work industry, while 29.28 percent in furniture. Cabinets and flooring account for 10.00 and 6.43 percent respectively, and other industries for the remaining 16.43 percent.
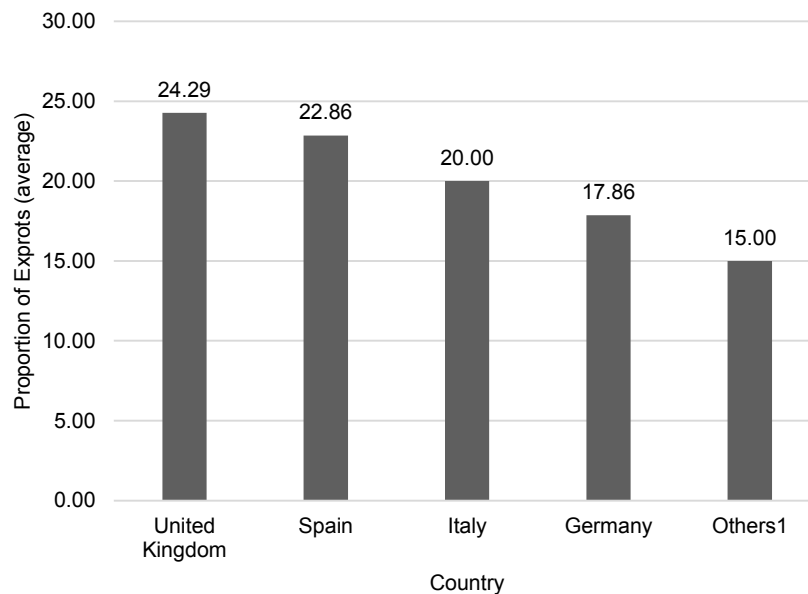
Figure 3.11 Distribution of Exports of U.S. Hardwood Lumber to Europe (averages)

The top three hardwood species exported by sample firms to Europe were as follow: white oak, red oak, and yellow poplar, with proportions of sample of 38.57, 29.57 and 12.85 percent respectively. When inquired about how European customers bought their products, respondents indicated that, in 40 percent of the cases, orders were directly placed to their U.S. office; whereas export sales made through wholesalers in Europe represented 33.33 percent of the sample. Affiliates in Europe manage 20.00 percent of the exports in average; and wholesalers in U.S., a 6.67 percent.

3.4.4.2   Export Strategies

Those responding firms that are currently exporting to Europe, defined as their main strategies to ensure future growth in the area, *increasing promotion and advertisement*, and *introducing new product features* (Figure 3.12). The former appear in 42.86 percent of the responses, while the latter in 28.57 percent of instances. The factor *improving prices*, represents the third strategy in importance: 14.29 percent of sample; and *others* accounts for the remaining 14.29 percent. The three top factors to improve profitability in the European export market, are *increase productivity, reduce manufacturing cost*s, and *improve prices*; which represent 26.32, 26.32 and 21.05 percent of sample respectively (Figure 3.13).   Factors such as *reduce transportation, promotion, advertisement costs*, and others, account for 26.31 of the sample.
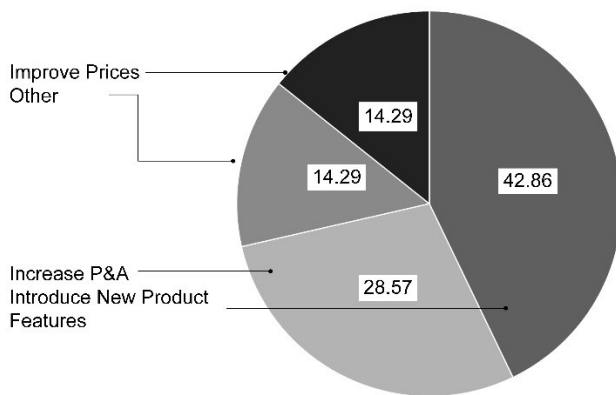
Figure 3.12 Respondent's Plans for Growth in Europe
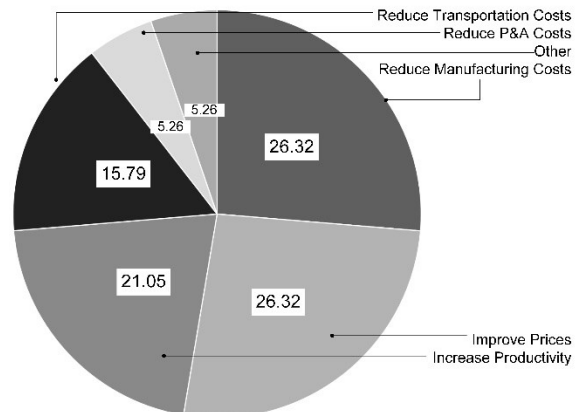
Figure 3.13 Respondent's Plans to Increase Profitability in Europe

This study also assessed the importance of the sixteen *order winner* factors commented in section 3.4.3.2. 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 seven points, which is condensed into a three-points-scale for simplicity of reporting some questions (i.e.

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1 –not important, 2 –neutral and 3 –important). The index depicted in the two upcoming figures (Figure 3.14 and Figure 3.15) was obtained by multiplying the value of each scale item by the number of observations obtained respectively. As it was also observed for the previous region, those factors directly related to the product *quality* and *packaging* were ranked the highest – 100 percent of respondents placed these as *important* (Figure 3.14). 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 85.71 percent of the instances. None of the sixteen factors were highly considered as *not important* or *neutral*. However, it is interesting to observe that, if these two categories are combined; it is found that *color sorting*, *dimension parts*, *custom grading* and *pre-surfacing* have almost 50 percent of their answers to be such.
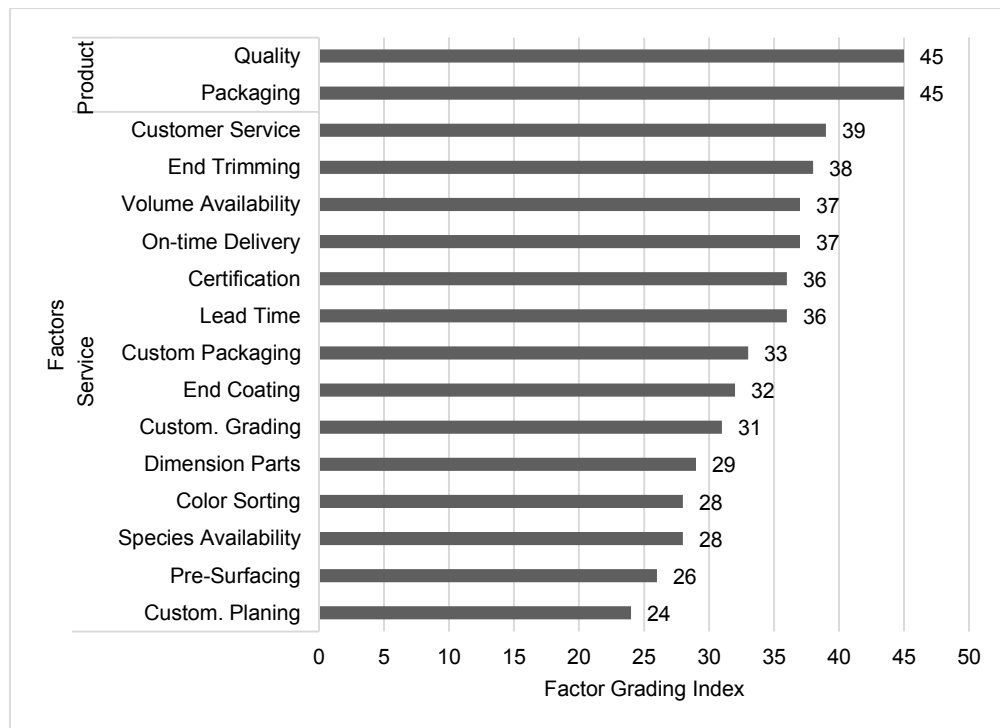
Figure 3.14 *Export performance* Factors (Drivers) in European Markets

When studied the socio-cultural characteristics of European markets, and their impacts on *export performance*; researchers found that the top three factors importance, from the respondents' perspective area: *business ethics*, *customs and traditions* and *values, beliefs and attitudes*; which correspond to 100, 71 and 71 percent of the sample respectively (Table 3.5).

Table 3.5 Importance of Socio-cultural Characteristics of European Markets in Respondent's *Export performance* (percentages)

Factor	1- Not Important	2-Neutral	3- Important	Total
Business ethics	0.00	0.00	1.00	1.00
Customs and traditions	0.14	0.14	0.71	1.00
Education level	0.00	0.57	0.43	1.00
Language	0.14	0.29	0.57	1.00
Religion	0.14	0.71	0.14	1.00
Values, beliefs, attitudes	0.14	0.14	0.71	1.00

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 3.6. In contrast with the previous question, whose responses in the *important* category account for 59.52 percent of the sample, here the political-regulatory factors were regarded as important in 84.13 percent of the instances, so that answers in the *neutral* and *not important* classifications account for 15.87 percent of the sample. It was also found that four factors were considered important by all respondents, which relate to the position adopted by the government of European countries towards U.S. hardwood companies, in particular their attitude towards foreign business, control and protectionism of the local industry, the political system and country's stability.

Table 3.6 Importance of Political-Regulatory Characteristics of European Markets

Factor	1- Not Important	2- Neutral	3- Important	Total
Bureaucracy	0.00	0.14	0.86	1.00
Business Protection	0.14	0.14	0.71	1.00
Gov. Foreign Policies	0.00	0.29	0.71	1.00
Gov. Attitude to Foreign Business	0.00	0.00	1.00	1.00
Gov. Controls/protectionism	0.00	0.00	1.00	1.00
International Association	0.29	0.29	0.43	1.00
Political System	0.00	0.00	1.00	1.00
Political stability	0.00	0.00	1.00	1.00
Regulatory System	0.00	0.14	0.86	1.00

3.4.5   General Questions about Exports

The last section of the survey addresses two general aspects of the export venture. More specifically, respondents were asked to provide opinion about the value added by distinct institutions in improving their performance. Then, the questionnaire concludes by inquiring the responding firms about the growth of sales and profit, driven by international markets in 2012. The Figure 3.15 depicts the assessment of domestic efforts to help companies improve their performance in international markets. The question consists in a set of eight items, which were evaluated using a Likert scale of seven points (categories) for importance. An index was created using the frequency count of responses, and weighted by the Likert categories (one to seven). According to this assessment, responding firms find 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 three factors correspond to the support efforts coming from *Foreign Government Agencies*, *University extension programs* and *others*. If was found that

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respondents regarded the effect of these programs as neutral, rather than not important. For example, within the *University Extension Programs* variable, 42.86 percent of the sample considered them neutral, whereas the important and not important categories, accounted for 28.57 percent of the sample each.
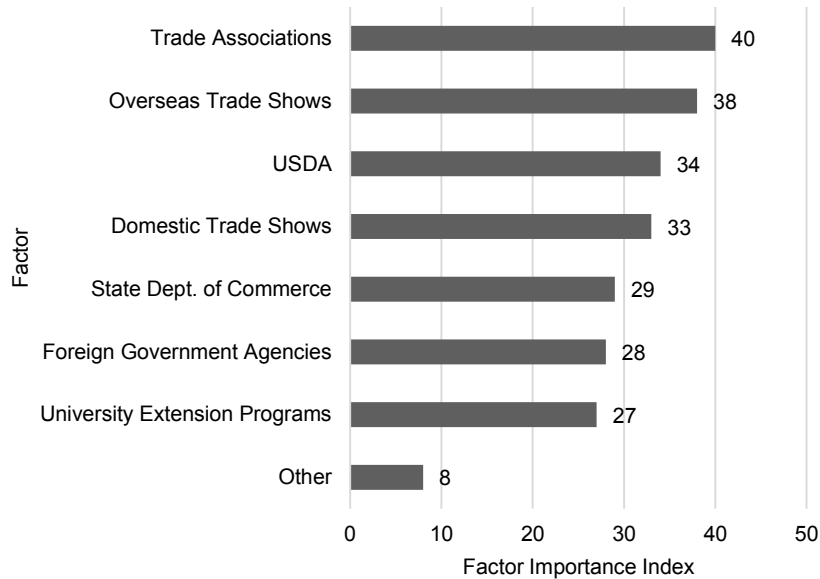
Figure 3.15 Importance of Export Support Efforts

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 3.4.2. The focus of the remaining section and following discussion will be the growth of exports throughout 2012. In Figure 3.16 it can be observed that, 75 percent of firms in the sample experienced an increase in export sales during 2012, in comparison to 2011. The majority of these firms (37.5 percent) achieved an increase in sales within the 11 to 15 percent range. That additional portion of sample which also experience

growth in export sales, is equally distributed among the following categories: 1 to five percent, 16 to 20 percent, and more than 26 percent; each accounting for 12.5 percent of the sample.
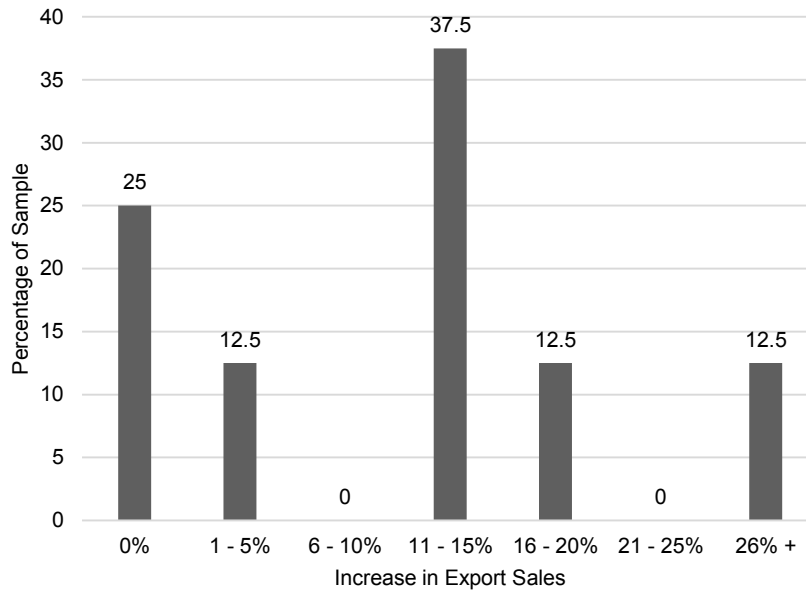
Figure 3.16 Increase in Export Sales of Hardwood Lumber: 2012 vs. 2011

3.4.6   Modeling

In the last section of the study, researchers investigated the potential associations between explanatory and response variables for Asian and European markets separately. The questions analyzed in this section correspond to those in *Marketing to Asia*, *Marketing to Europe*, and *Export Performance* groups of the questionnaire.

The first task performed by researchers in this part of the study, consisted in measuring the reliability of the variables selected for the modeling process. For this purpose, the Cronbach's alpha coefficients (Cronbach & Meehl, 1955) were estimated for the export performance factors previously cited. As it has been depicted in Table 3.7, all factors can be considered reliable, as the

coefficient is higher than 0.7 (Carmines & Zeller, 1979). This means that variables included in each one of these factors provide consistent results throughout the sample using the seven-item Likert scale, and may be considered for future research. The only exception was found in question 12, where the original coefficient amounted 0.64, but after removing variables Q12_5 (*business ethics*) and Q_16 (*language*) the coefficient improved to 0.81. For more clarity, a list with all variables has been included in appendix Appendix D.

Table 3.7 Cronbach's Alpha Coefficients

Question	Factor	Region	Variables	Cronbach's Alpha 7-item	3-item
11	Product/Service	Asia	Q11_1 – Q11_16	.90	.90
12	Socio-Cultural	Asia	Q12_1 – Q12_6	.81*	.81*
13	Political-Regulatory	Asia	Q13_1 – Q13_9	.90	.90
21	Product/Service	Europe	Q21_1 – Q21_16	.90	.90
22	Socio-Cultural	Europe	Q22_1 – Q22_6	.88	.88
23	Political-Regulatory	Europe	Q23_1 – Q23_9	.91	.91
27,29	Export Performance	All	Q27,Q29	.83	NA

The second step of the analysis consisted in elaborating contingency tables to evaluate the relationship between the *export performance* factors, socio-cultural and political-regulatory characteristics of the export markets, all of which were defined as explanatory variables in the research design, against the four response variables also implemented in this inquiry: sales, sales growth, profit and profit growth. The independence between these sets of variables were tested with Fisher's exact test (Agresti, 2002). Considering the fact that each one of the explanatory factors, in turn, consists of multiple variables, a separate contingency table was prepared and analyzed for each variable (appendix Appendix D). The next step in the analysis, involved performing logistic regression between all the explanatory variables altogether and each one of the

response variables. In other words, the researchers determined models that relate the independent variables with sales, sales growth, profit and profit growth.

3.4.6.1 Asia

In general, the independence tests conducted for the survey data indicated the presence of a weak association among the variables, when studied separately. As it has been depicted in Table 5.8 (Appendix 8), factor A denotes those variables related to the characteristics of products and services offered by participant firms, which correspond to the order winners described in section 3.4.3.2, whereas factors B and C correspond to socio-cultural and political-regulatory characteristics respectively. The outcome of these tests, demonstrate that for variables included in the *export performance* model, strong dependencies may not be present on one to one comparisons. While it is true that these results are important to contradict the conceptual model proposed in this study, it is critical to highlight that the magnitude of the dependencies when variables are considered altogether. For this purpose, multinomial logistic regression was conducted for each one of pair of sets previously cited. The outcome is depicted in Table 5.10. Here it can be observed that contrary to the early results of this analysis, some of the variables do contribute significantly to the regression model to explain the behavior observed on the *export performance* variables. For instance, when researchers modeled the political-regulatory factors against the growth in sales, it was found that *political system* and *regulatory system*, help in reducing the error of the model significantly.

3.4.6.2 Europe

The results of the analysis for independence and logistic regression are shown in Table 5.9 and Table 5.11 respectively (Appendixes Appendix G and Appendix H). As it was found in for the Asian makers, most of the variables analyzed in factors A to B did not appear to the *export*

performance metrics; the only exceptions being *gov. foreign policies*, which showed a *p*-value of 0.02 when compared against *profit growth*. Other variables such as *product quality* and *values, beliefs, attitudes* presented p-values of 0.07 for the same test. However, the logistic regression revealed that altogether, some variables contribute to the modeling of the *export performance* variables significantly. For example, when factor A was modeled against *product growth*, variables *product quality* and *packaging quality* presented *p*-values below the significance level *alpha* of 0.05, which indicates the existence of a dependency with can be expressed in terms of a logarithmic function. This analysis revealed that, overall, all the response variables (sales and growth-related), can be modeled through a combination of the factors displayed in the research design, with the only exception of *sales growth,* where it is found that no variable, either separately or in combination with other variables, provided a reasonable explanation on the behavior of the same. The Figure 3.17 provides a summary of the associations found for both Asia and Europe. In the center of the figure are found the two export performance variables (dependent) chosen for this study: *sales growth* and *profit growth,* where the left side of the figure corresponds to the modeling performed for Asian market, and the right to the same of Europe. The boxes on the right and left sides represent those independent variables which were found to have a significant contribution to the regression models (separate regression analyses were conducted for each dependent variable). Each one of this boxes has been connected to the respective dependent variable if the former was found to provide a significant contribution to the modeling of the latter. For instance, it was determined that *Q11_2: Package Quality* can be used to estimate *profit growth* but not for *sales growth*. Three types of lines (dash, solid, and short-dash) were used for the boxes are connectors to code the three explanatory factors addressed in this study: *product/service, socio-cultural* and *political-regulatory* respectively.
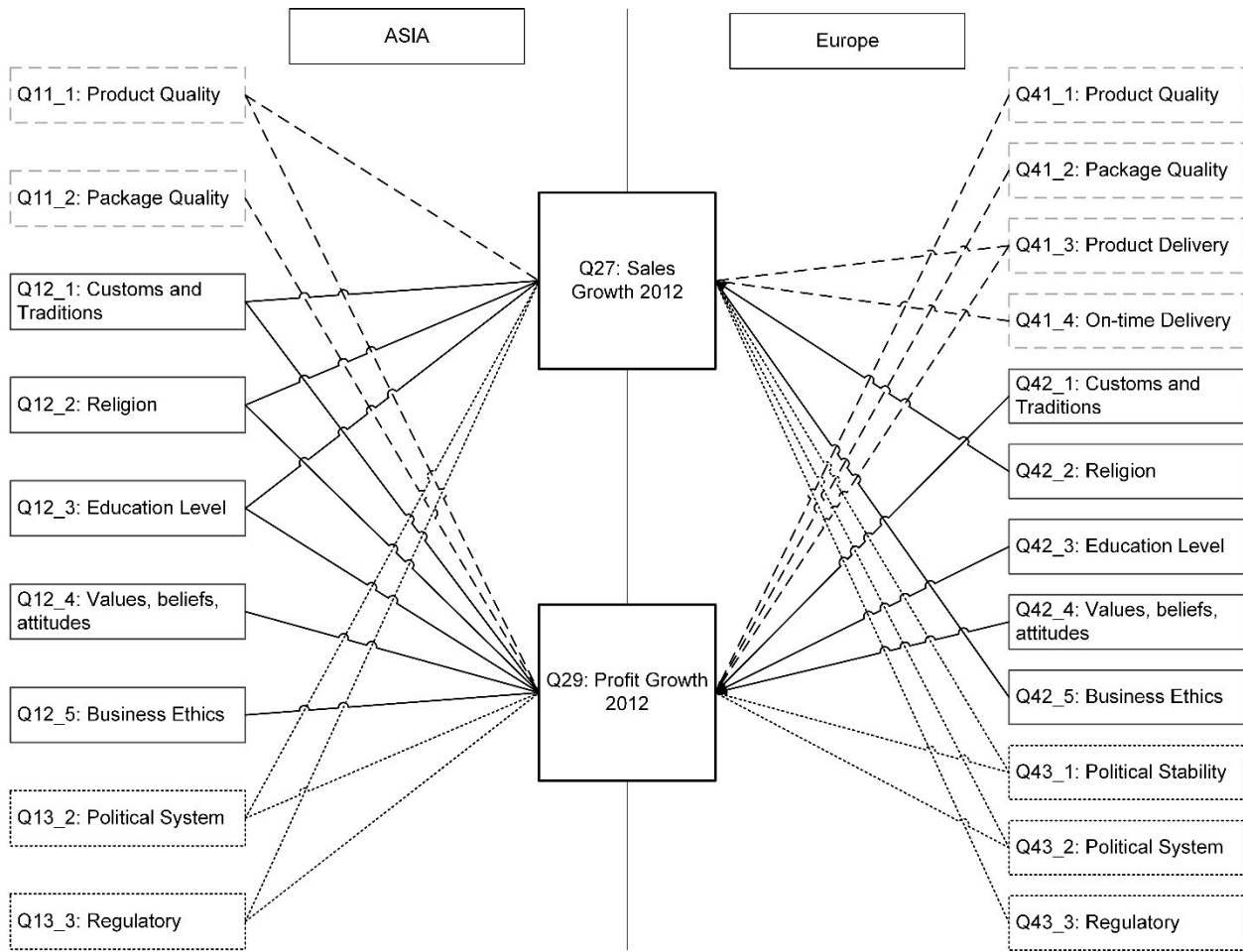
Figure 3.17 Summary of Results Logistic Regression: Asia and Europe

3.5   Discussion

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.   In general, previous research suggest that

business performance, either in domestic markets or international markets, depends on the internal

characteristics of the firms and how the same utilizes its resources to address specific markets

needs and strategies, along with those aspects that typify the markets themselves and certain

specific features of the domestic market.   What differentiates one study from the other in the

literature, is the context in which the study was conducted, and those variables on which the focus remained. This study has attempted to comprehend, not one, but multiple dimensions of the *export performance* problem, at the expense of limiting its number of cases to a rather small sample size, but with the benefit of having addressed more than one hundred variables in total.

A key aspect of the nature of the phenomena studied, which has been confirmed by this research, is the fact that improving performance is the result of addressing multiple variables or elements simultaneously. For example, the analysis conducted on the *export performance* metrics related to sales or revenue indicate that for both the absolute and percentage metrics, the former is influence 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 eighty-six variables studied in section 3.4.6 (Modeling), only thirty-two (sixteen per geographic region), correspond of the characteristics of the product and services offered by hardwood lumber exporters. It is important to reflect that these variables, are those more easily and directly handled by the firms themselves. Moreover, these variables, typified as *order winners*, due to their effect in the competitiveness of the firm, constitute the operationalization of all the marketing strategies and tactics discussed in sections 3.4.3.2 and 0. 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 as the main drivers in business transactions, not only of hardwood lumber, but industrial goods in general. However, what this study has also reveals, is 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. There has been abundant studies on quality of hardwood lumber products, and research on technologies to make the grading process more efficient, continues both in the industry and academia. However, the information generated thorough this research project, seems to suggest that improving quality on service, may lead firms to improve their positions on the international markets.

The analysis of the socio-cultural factors involved comparing six explanatory variables, against four measures of export performance. The explanatory variables are: *customs and traditions*, *religion*, *education level*, v*alues, beliefs, attitudes*, *business ethics*, and *language* (Table 5.2). The response variables correspond to *export sa*les, *export sales growth*, *export profit* and export profit growth (Table 5.4). According to the regression analysis performed for Asia (Table 5.10), all these variables are associated with *export sales*, except v*alues, beliefs, attitudes* and languages. When compared against export sales growth, the only explanatory variables with presented a significant association were *customs and traditions*, *religion*, *education level*. None of the variables showed association with *export profit*, but all of them seemed to be related to export profit growth.

When a similar analysis was performed for Europe, none of the six explanatory variables appeared to be related to *export sales*, and only *religion* and business *ethics* presented significant associations with *export sales growth*. Similarly, no association was found for export profit, but *customs and traditions*, *education level* and *values, beliefs, attitudes,* demonstrated significant associations with *export profit growth*.

The analysis of the political-regulatory aspect of the export markets involved, nine explanatory variables *political stability, political system, regulatory systems, government attitude towards foreign business, controls and protectionism, bureaucracy, business protection, international*

association, and gov. foreign policies (Table 5.3). The explanatory variables are same as previously discussed. According to the regression analysis for Asia Table 5.10, the only associations observed in the data correspond to the explanatory variables *political system* and *regulatory system*, against *exports sales growth* and exports *profit growth*. The same analysis for Europe Table 5.11, revealed that *political stability, political system* and *regulatory system* are strongly associated with *export sales growth*. It was also found that *political stability, political system are associated* with *export profit growth*. Neither *export sales* nor *export profit* presented associations with the political-regulatory variables in Europe.

This last step of the analysis indicates that, even though the total level of sales or profit might not be related to the political-regulatory variable, the growth in both is related. This is particularly important for small firms: getting to know the customers, and how to maneuver in international markets is critical to see a return on investment for an export venture. A similar logic applies to the cultural factor, which relates to the *growth* variables. Moreover, since some of the socio-cultural variables do relate to the total level of export sales, not only long term growth, but short term revenue, may depend on being more knowledgeable about of the customer, which may require a focus in developing "significant" relationships with the same.

3.6   Conclusions

The identification and understanding of factors impacting international markets for hardwood products in key US overseas markets is essential for US hardwood producers to shape successful marketing strategies. 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 purpose of this research is 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 twenty-seven responses were obtained from the members of NHLA, out of which, at least seven observations contribute only with partial information. This represents less than 3 percent 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.

Getting to know the customer and the context in which it operates, appear to be critical for the growth of the export venture. A business relationship may be limited to the day to day transactions, however, the analysis of the socio-cultural and political-regulatory, indicate that investing in developing long term relationships with customers, may contribute to obtaining competitive advance, and hence improving export performance.

The research approach selected for this study has been beneficial in providing insights on multiple dimensions of the hardwood export business. It was possible to study not only the fundamental aspects of the product and service, and their implications to competitiveness and export performance, but critical characteristics of the market, such as the socio-cultural and political-

regulatory, were also addressed. However the length of the questionnaire, the type of information required from respondents (financial in particular), and the survey mode chosen for the study (Web), may have cause the response rate to decrease drastically. Some suggest that there is a general decline in response rates for Web and email surveys in the United States (Sheehan, 2001). In order to work with low response rates, Dey (Dey, 1997) recommends the use of "Weighting Adjustments" as an effective approach to reduce non-response bias in univariate distributions. However, he also admits that the efficacy of the same is less than certain for correlation and regression, which are central for this study.

It is because of the small response rate, that conclusions obtained in this study need to be carefully analyzed and interpreted. It is known that the effectiveness of a survey design, will depend largely on the characteristic of the target population, but since only mode was selected for the study, it cannot be concluded that web surveys are not appropriate of the hardwood lumber companies. Future research needs to contemplate the possibility of implementing mixed methods.

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4 A Demand-Pricing Management Approach to Add Value in the U.S. Hardwood Industry

Abstract

It is a common practice for companies to determine their prices based on cost plus a profit markup and or market prices. The hardwood lumber industry usually works in a similar way. The problem with these approaches is that they are usually based on arbitrary decisions and do not account for the risk of either setting prices to high and therefore losing demand, or too low and leaving money on the table. The goal of this study is to test a demand-pricing methodology based on mathematical modeling, that have proved to be successful in increasing profits in other industries, and that may also be valuable in the hardwood lumber industry. There is a particular interested in exporting firms because it is considered that they have to deal with more challenges and complexities at the time of determining prices than those whose focus remain only on the domestic market. In this study, researchers analyzed historic sales data in order to determine optimum pricing values for each product in each geographic region, which will serve the sales and marketing groups in negotiating with customers abroad. It was observed that in specific circumstances, the suggested approach, which is based on statistical modeling and mathematical optimization may lead to higher profits than the traditional pricing method.

4.1 Introduction

4.1.1 U.S. Hardwood Industry

The U.S. hardwood industry suffered a continued decline from 1999 through 2009, in part as a consequence of the collapse of the domestic housing market and the overall economic recession that followed. Despite of the efforts of US government to incentive economic expansion through stimulus spending, the economic growth slowed following cutbacks in the federal government cash infusions. Improvements in the domestic and global economies have led to a slow recovery of the U.S. Hardwood industry, particularly on traditional markets such as pallets and crates, and non-traditional markets, as the exports sector for instance. Exports haven't come to raise the industry's total production levels to match 1999 records (12.9 BBF), but they have certainly become a key market for short and long-term growth. Firms need to have a good understanding of the characteristics and dynamics of markets to formulate proper strategies to increase growth and improve profits. In the previous chapters, four main dimensions of the business have been found to have a potential impact on *export performance*: characteristics of the Product, Service, Market and Firm (supplier). It has been found that product-related 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. In *Competitive Strategy*, Porter states that there are two basic types of competitive advantage: "*differentiation*" and "*cost leadership*" (Porter, 1985). Those firms which pursue to *differentiate* themselves from the rest of the industry, look for opportunities to excel in some dimensions that are highly valued by customers, within a specific market. On the other hand, cost leadership consists in becoming the low-cost producer in an industry, by exploiting all sources of cost advantage, derived by the industry structure.

Those supply decisions with the objective of lowering the cost of production and delivery (Talluri & Van Ryzin, 2005) and improving the efficiency and coordination of the value chain (Hopp & Spearman, 2008) are addressed by *supply-chain management* (SCM). SCM as a management philosophy, establishes that each company in the supply chain impacts the performance of the other involved firms, along with the overall results of the entire chain (John, William, James, Soonhong, & et al., 2001). More specifically, Mentzer's definition of SCM is: "… *the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across business in the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole"* (John et al., 2001). Now, even though improving competitiveness in price, is mainly driven by cost minimization efforts, which falls in the supply management category of efforts, there are other dimensions of the management of prices that may also help firms and value chains in offering more competitive prices and increasing revenue. In the operations research and management science literature, it was found that for other industries, it has been possible to improve pricing via mathematical programming, in such a way that demand is not lost, and greater value is obtained by organizations, out of a business venture. As it will be discussed in detail in the following section, such studies belong the field of *revenue management*. The purpose of this phase in the study, is to explore the principles of *revenue management* (RM) and its application to those *revenue and pricing decisions* that may serve as a complement to the *supply decisions* addressed by SCM, and increase the value of the U.S. export business.

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4.2   Literature Review

4.2.1   Revenue Management

As previous research shows, pricing is a key factor in the performance of a firm in international markets. Nowadays, it is a common practice for companies to determine their prices based on cost plus a profit markup and/or market prices (Dolan, 2008). The hardwood lumber industry usually works in a similar way. The problem with these approaches is that they are usually based on arbitrary decisions and do not account for the risk of either setting prices to high –and therefore losing demand, or too low and leaving money on the table. The goal of the next phase of my doctoral study is to test a pricing methodology based on the principles of Revenue Management, that have proved to be successful in increasing profits in other industries, and that may also be valuable in the hardwood lumber industry. The focus of this phase will be centered in exporting firms because they have to deal with more challenges and complexities at the time of determining prices than those which focus on the domestic market.

Revenue Management (RM) is the discipline within Scientific Management that deals with pricing questions such as: "*how much to ask?*", "*when to drop the price (if at all)*", "*what the asking price should be?*", "*which offer to accept?*" among others, towards maximizing profitability. In other words, RM is concerned with demand-management decisions (Talluri & Van Ryzin, 2005). In fact, RM is also known as demand management, yield management, pricing and revenue optimization, etc.

Above questions are rather old concerns in business, as old as the notion of free market itself. But what is innovative about the RM approach is the application of principles and techniques original in operations research to find the right price for "every product, to every customer segment and through every channel" (Phillips, 2005). It is based on the fact that markets are not perfect, and in

those imperfections lies the opportunity to improve prices beyond what the market dictates, in such a way that profits are also improved (Ross, 2008).

Considering that RM literature in the forest products literature is practically inexistent, the study will start with the analysis of a fundamental element of the pricing optimization process: the *price-response* function (*P-R*). The *P-R* function (also known as *P-R* curve) establishes how the demand of a product varies as a result of a change in price. This function (Figure 4.1) is seller specific – companies supplying the same product to the same market will show distinct curves, and it has the properties of being: non-negative, continuous, differentiable and downward sloping (Table 4.1). Common Price response functions are: linear, logit, S-shaped, among others (Phillips, 2005).
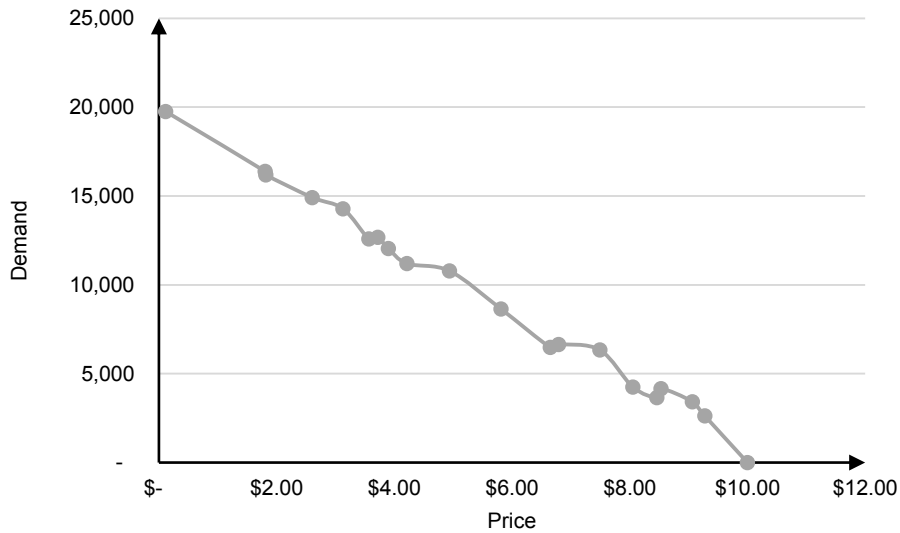
Figure 4.1 Typical price-response figure.

Table 4.1 Characteristics of price-response functions

Characteristic	Description
Non-negativity	The prices are either zero or positive *Domain of $d(p)$*: $\mathbb{R}^+$
Continuous	Basically, the function is defined for every price *p* in the domain of *d(p)* (Weisstein, 2014).
Differentiable	The derivate of *P-R* function exists at any point within its domain.
Downward sloping	The value that represents the inclination of the curve, is always negative, for any price *p* greater than zero.

Determining the *P-R* function is necessary to address the basic price optimization problem which consist on maximizing the total contribution *m*. Each customer order sold at a price *p* and with a cost *c*, has a unit margin equal to *p* minus *c* (Phillips, 2005). Therefore total contribution is defined as following:

$$m(p) = (p - c)d(p) \qquad (4\text{-}1)$$

In general the total contribution function (Figure 4.2) is concave, with an apex located at the point where the first derivative equals zero. In other words, the point is where total contribution is maximized and the price is optimal (*p**).
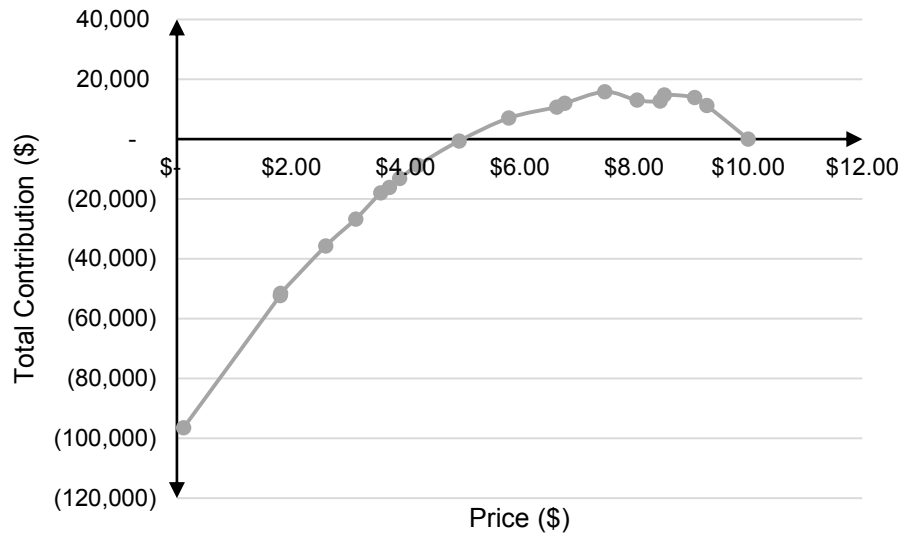
Figure 4.2 Typical Total Contribution as a Function of Price

This simple model grows in complexity as more elements such as supply constraints and price differentiation criteria (e.g. by geographic region) are incorporated. However, for the purpose of this study, the basic unconstrained will the focus of attention. In this study, historic sales data were analyzed in order to determine optimum pricing values for each product in each geographic region, which will serve the sales and marketing groups in negotiating with customers abroad in a lumber supply non-constrained scenario.

4.2.2 NHLA Rules for Lumber Grading and Pricing

The National Hardwood Lumber Association (NHLA), established over 100 years ago, rules the grading U.S. timber industry, and provides the basis for its commercialization both in the domestic and export markets. The aim of the NHLA grading is to provide the buyer and seller with a common language based on the quality of the product. According to the NHLA rules book

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(NHLA, 2011), the higher the grade, the higher the percentage of clear areas in the board's surface. A clear area is free from knots, splits, cracks, stain, rot and wane (Wengert, 2005). The basic grades in NHLA rule book are: FAS, Select, FAS 1-Face, No. 1 Common, No. 2A Common, No. 2B Common, No. 3A Common and No. 3B Common.

The term "*grade lumber*" has been used for lumber that is sold under NHLA rules, or close variations of them. It includes ungraded lumber supplied by small sawmills that is later graded by the purchasers (Luppold, 1996). The term "*non-grade hardwood product*" is used for products not sold under NHLA rules. In general, products such as pallets, crossties, construction materials, bridge timbers, and upholstered furniture frame stock fall in this category. Nevertheless, some of these may also be graded for strength and durability according to their use. This conceptualization of terms will be used in this study to refer to lumber that fulfils such characteristics. As a consequence of the fact that the NHLA rules are based on the location and size of defects and do not consider color or appearance in the grading; many large sawmills have developed proprietary grades to classify their lumber also by appearance, which is also considered in buyer-seller pricing negotiations. Sellers differentiate their product in quality, color, widths, lengths, buyers' specifications and related sorting and separation costs (Luppold, 1996). This creates differences in prices reported in hardwood publications. The principal pricing publications for hardwood lumber Hardwood Market Report (HMR) (9) and the Weekly Hardwood Review (WHR).

There is a relationship between lumber grades, yields and costs and understanding its complexity is necessary to understand how lumber is priced in the U.S. In general, the better the grade, the higher the cost and the yield faced by the manufacturer. The price of lumber also varies if it is green wood or dried wood. Additionally, the price of the kiln-dried lumber can set in two ways: gross and net tallies. The term "*gross tally*", is used for kiln-dried lumber that is measured and

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sold before drying. Consequently, "net tally" is a term used to indicate that lumber was measured and sold after being kiln drying. In both circumstances, lumber should be inspected and graded after drying.

The hardwood lumber distribution system consist of five components: hardwood sawmills, concentration yards, distribution yards, wholesalers and brokers. Individual companies can be involved in one or more of these chain links. The major purchasers of grade lumber industry the wood household furniture, mill work, flooring, kitchen cabinet, and export industries. The increase of international demand of kiln-dried hardwood lumber appears to be one of the main factors behind the re-shaping of its distribution systems. By the early eighties the concentration and distribution yards traditionally managed to fulfill most of customer's demand, but with the increasing in exports, changes in dry-kilning technology and the increasing average size of hardwood sawmills, there has been an accelerated increase in sales from the hardwood sawmills (Luppold, 1996).

4.3   Methodology

4.3.1   Overview

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. For this purpose, two lumber exporting companies were selected to conduct the study. 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 two 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 testing to determine the relationship between price and demand for each product configuration. Those products that presented strong negative linear correlations in their *P-R* functions (Figure 4.3) 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 programing was used to find the price level in which each is maximized, and therefore serve 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.
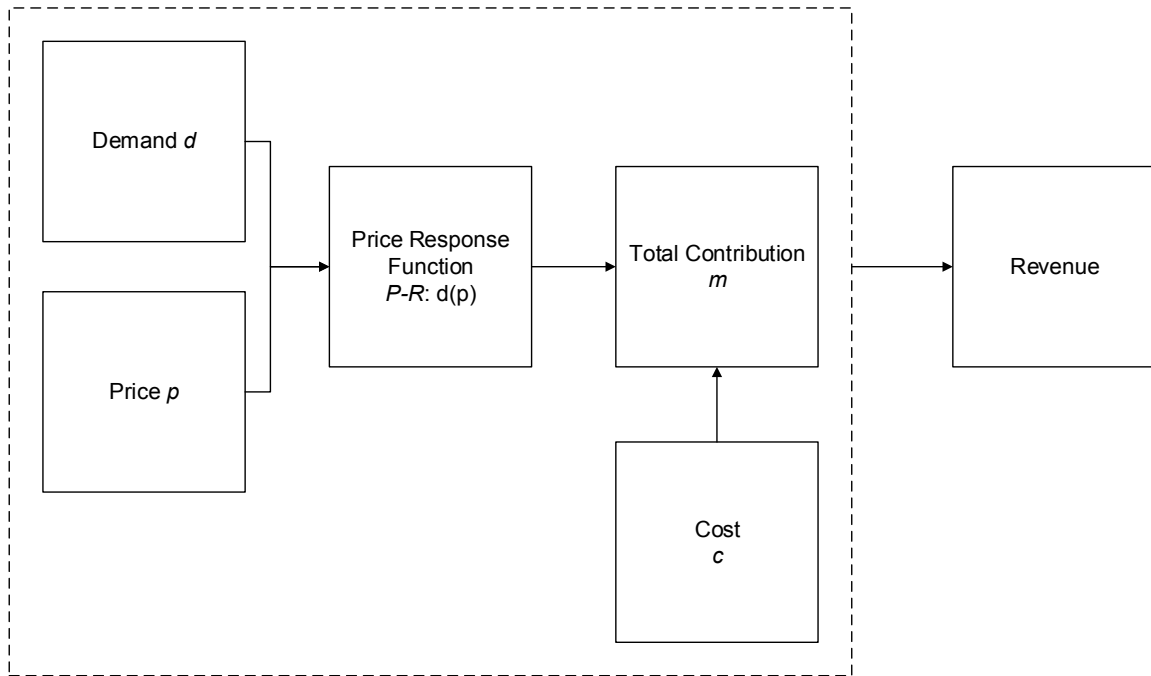
Figure 4.3 Diagram of Modeling Process (overview)

4.3.2   Case Study Methodology

Case study research, is an investigation strategy in which one or a small number of cases, are examined in their real life context (Jan & Tony, 2008), with the purpose of collecting qualitative and qualitative data, to test a proposition or set of propositions chosen beforehand. A "case", is the unit of the study, which may be an individual, an event or a less well-defined entity such as decisions, programs, implementation processes, among others (Yin, 1994). This empirical inquiry approach is found to be appropriate to address research questions of the type "how" and "why", in explanatory, descriptive or exploratory studies, where statements are tested by analyzing data obtained through observations.

A research project can be either theory-oriented, or practice-oriented. In theory-oriented studies, the goal of the research of to contribute to the development of theory. Whereas the practice-oriented research, is driven goal of contributing to the knowledge of practitioners in a specific context. The case study methodology can be used in both modalities. Theory development, in particular, consists in three main types of activities: exploration, theory-building research and theory-testing research (Jan & Tony, 2008). In general, the purpose of exploratory studies is to find and select propositions, from the literature or practice, which may be subject to further study, either because such propositions need further empirical evidence (i.e. replication), have never been tested, or because there are aspects of the object of study that lack of propositions. This class of theoretical propositions, frame causal relations between the concepts (operationalized as variables) on which a particular object of study is based in a given context. The expected outcome of an exploratory study, is a proposition, or set of propositions, to be tested in actual research studies. The goal of theory-testing research, is to test a proposition, through experiments, surveys, or case studies, depending on the nature of the proposition, and formulate a hypothesis about the instances chosen as per the research strategy. Case studies are utilized in this type of research to determine if the observations drawn from a one or a small number of instances support or not the propositions studied. For the theory-building research, on the other hand, the case study methodology is specially appropriated when little is known about the object of study, when current theories seem to offer only partial support or even conflicting views on the same (Eisenhardt, 1989). In this sense, case study research is performed with the goal of offering new insights and theories, by either complementing other research strategies or as the solely source of supporting data.

4.3.3 Case study Design

Following are the five main components of this case study's design, which are based on the framework proposed by Yin (Yin, 1994).

4.3.3.1 *Research Questions*

1. What are the characteristics of the international customer's demand for U.S. hardwood lumber products?

2. What impact on the revenue, can a pricing policy based on the relation between price and demand, have on a hardwood lumber firm in the U.S.?

4.3.3.2 *Propositions*

It is proposed that the revenue (R) generated by the sales of U.S. hardwood lumber in international markets, will be higher in the long term, for a procedure based on the optimization of the *P-R* function, than one based in cost plus profit markup approach (*cost plus* for short):

Null hypothesis: $H_0: R_{P-R} - R_{Cost\ Plus} \leq 0$

Alternative hypothesis: $H_a: R_{P-R} - R_{Cost\ Plus} > 0$

4.3.3.3 *Unit of Analysis*

Although the interest is of this study, to provide the hardwood industry with innovative tools to increase the value of their exports, and thereby their performance in international markets, the unit of analysis itself is the product (i.e. hardwood lumber), whose demand, price and cost will be subject to inquiry. Therefore, it is the hardwood lumber product configuration (product for short) that will constitute the "case", in the case study. As it will be describer in further detail later in the

results section (section 4.4.1), this study involved the participation of two firms –company A and B, whereby company A contributed with data for thirty-two products, and company B for twenty-eight. Each observation in this case study correspond to the record of a sales order executed between 2012 and 2013 for the former, and 2013 for the later. Each observation is constituted by nine variables, with are depicted in Figure 4.4.
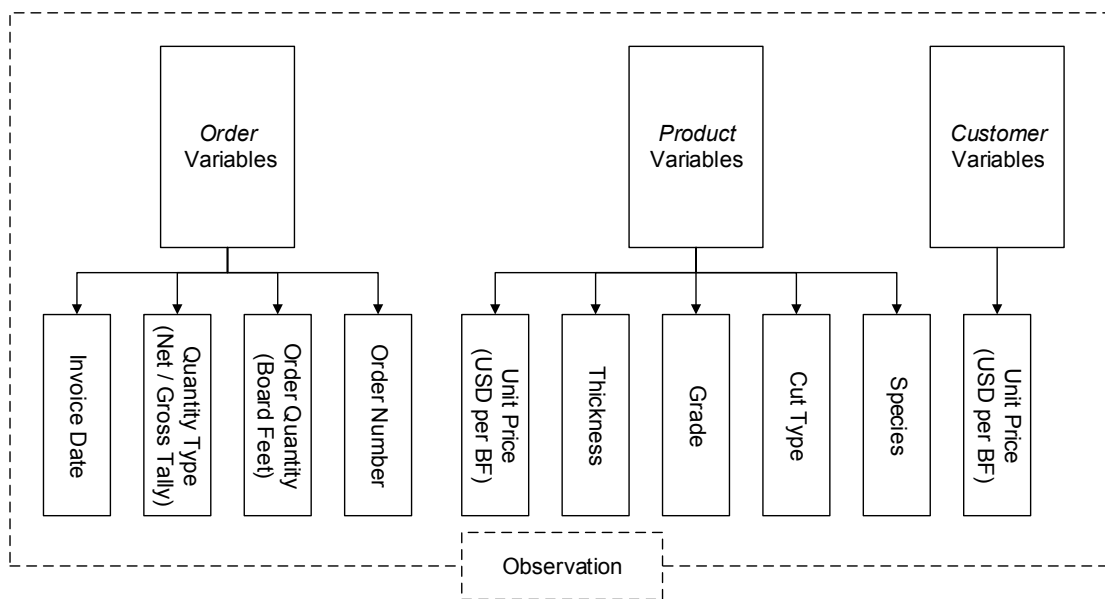
Figure 4.4 Case Study Design: Variables Studied

4.3.3.4   *Logic Linking Data to Propositions and criteria for interpreting findings*

The analysis of collected data consisted in three main phases (Figure 4.5). In phase one, exploratory data analysis (Tukey, 1977) was performed first on the demand (order quantity variable) and price (unit price variable) individually, for every combination of cut type, grade and thickness offered by each participating company. This analysis was performed by incorporating the variable of time, both explicitly and implicitly. Among the tools used by this phase of the

study were: Box-and-whisker plots, histograms, frequency counts and percentages and basic descriptive statistics. This analysis provided the researchers with insights of the mean values, extremes, and behaviors of the data. This were then used to partition the data as required for subsequent analysis. In the second phase of the data analysis, two types of associations between variables were studied. First, the prices of each hardwood lumber product was compared against the market, and thus compare the firms' pricing policies with those of the market. Second, prices were compared with their corresponding demands, to explore the patterns in the data, and to determine if the same met the requirements established by (Phillips, 2005) for pricing optimization: non-negativity, continuous, differentiable, downward sloping. For this purpose the following were used: scatter plot, correlation coefficients (Pearson's and Spearman's), and simple linear regression. Those cases which did not meet above requirements were discarded from the subsequent phase of the study.

The third phase of the study consisted in determining the total contribution curves for each one of the products that did meet Phillips's criteria. In this process, the general equation of m was set by substituting the P-R function and product's cost. Once the equation of m was determined for every instance in the case study, the researchers proceeded to find the value of price p that maximizes the total contribution via non-linear regression, which is explained with more detail in section 4.4.2.4. The goal of the last part of this research project, is to decide if the prices generated by the procedure previously explained, lead the involved companies to obtain higher revenue margins, that their current pricing policies. For that purpose, Monte Carlo simulation (Thomopoulos, 2013) was used to forecast the demand of products, for which the optimization modeling was carried out, for a three period horizon (corresponding to the first quarter of 2014). A Monte Carlo simulation is a procedure used to evaluate the empirical properties of quantitative models by generating

random data, fitting the population properties (Kelley). The random variables are used to address

stochastic or deterministic problems, where the effect of time is negligible (Law & Kelton, 1982).

For the same period, the pricing methodologies currently in place at the participating firms were

modeled via time series methods, whereas optimized prices were calculated following the

procedure previously described in this section. These three data sets were combined and revenue

margins for the two pricing approaches estimated. The two resulting series of margins were used

to perform a hypothesis testing in order to determine statistically, whether the margins derived

from the optimization methodology were greater than those coming from the procedure currently

in place. As a summary, the Figure 4.5 depicts logic linking data to propositions.
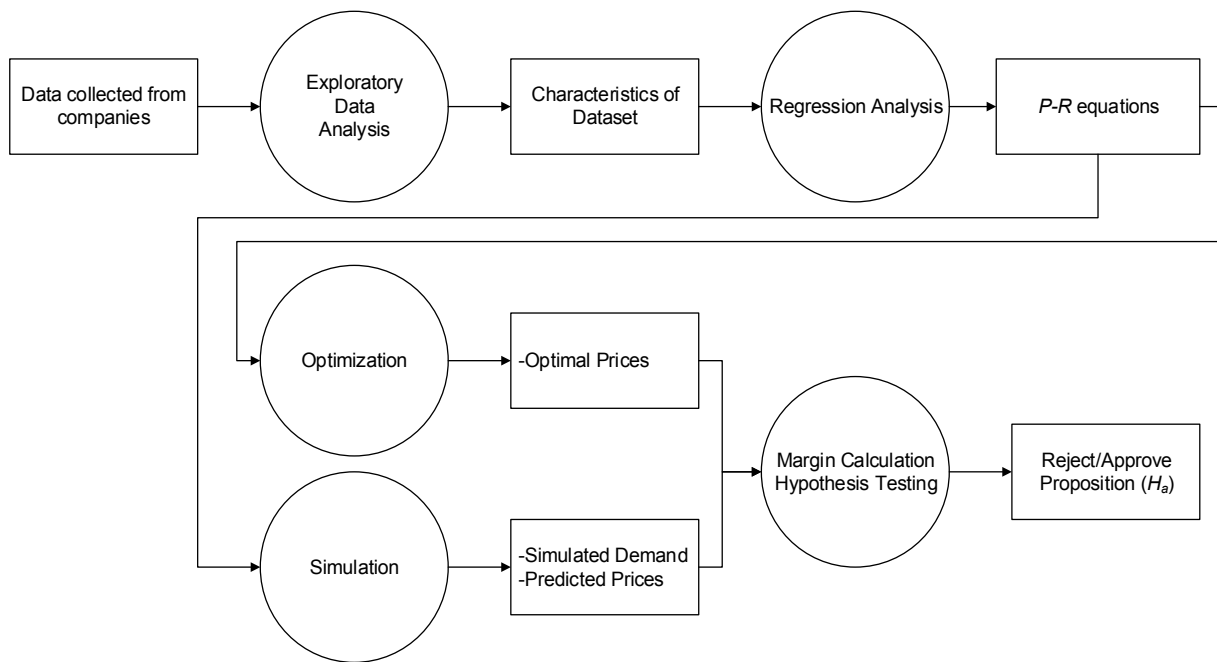
Figure 4.5 Diagram of Logic Linking Data to Propositions

4.4   Results

4.4.1   Overview

As it was indicated previously, the objective of this case study is to determine if a revenue management model based on pricing optimization is appropriate for the U.S. hardwood lumber export business.   For this purpose, a basic optimization methodology proposed by Phillips (Phillips, 2005) was selected to model the relationship between price and demand, and through a non-linear optimization (Hillier & Lieberman, 2010) solution algorithm, the price level that maximize the total contribution for each case was calculated.   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. Both companies are located in the Appalachian region, and trade their products in domestic and international markets.   These companies were selected from a pool of firms that participated in previous stages of this research project, and particularly because of their willingness to share historic data of export sales.   Company's A main export species is white oak (*Quercus alba*), which is offered in three distinct cut types, four grades and five thicknesses. Company B in turn, produces yellow-poplar (*Liriodendron Tulipifera*) lumber mostly for international customers, and it is offered in one type of cut, three grades and four standard thicknesses. Figure 4.6 and Figure 4.7 depict the data collection and management activities. These are described in more detail in the next sections.
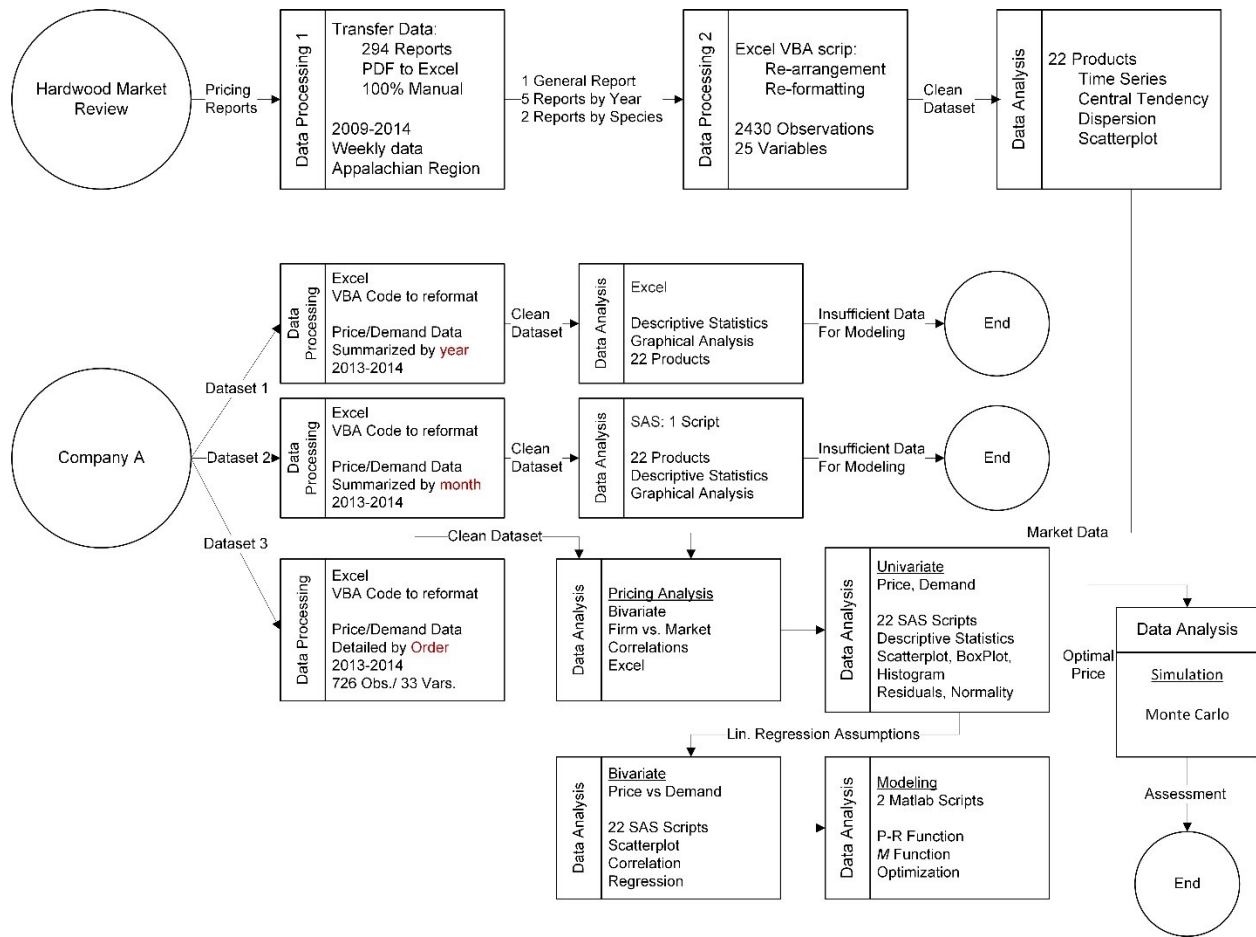
Figure 4.6 Data Management: Phase 3, Company A
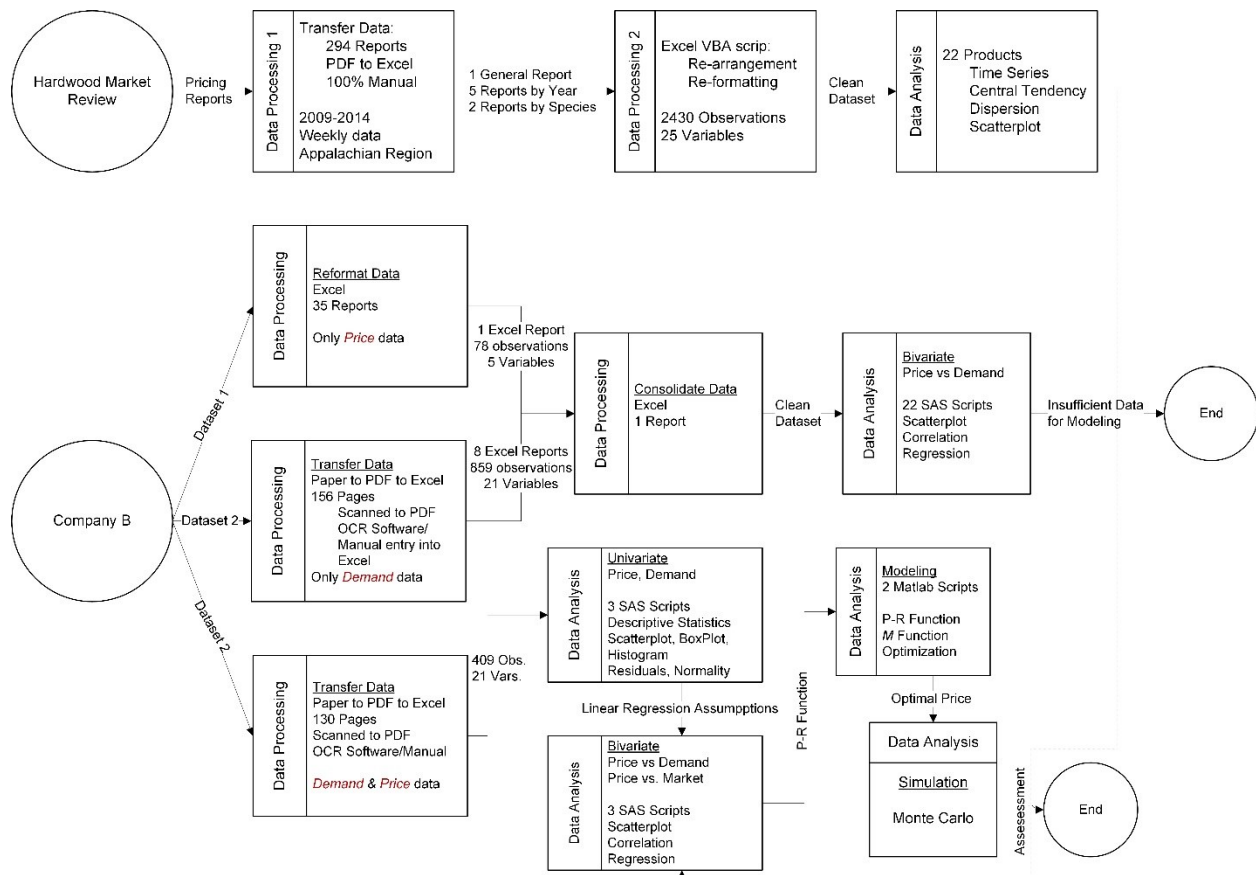
Figure 4.7 Data Management: Phase 3, Company B

4.4.2   Company A

4.4.2.1   *Market Prices for U.S. White Oak Lumber*

During the period between 2000 and 2013, the exports of white oak have represented an average of almost 19 percent of the total volume of U.S. hardwood lumber traded abroad, and have remained within the range of 16.00 to 20.43 percent. In terms of value, white oak accounted for an average of 24.14 percent of total U.S. lumber exports, with a minimum of 17.77 percent in 2013, and a maximum of 24.14 in 2009 (Figure 4.8). Approximately 93.26 percent of the white oak lumber exports (on volume), is distributed among four geographic regions: the European

Union, East Asia, North America, and Southeast Asia, which represented 26.92, 25.72, 20.41 and 20.16 percent respectively (FAS, 2014). Other regions account for the remaining 6.74 percent of the volume traded. Also in terms of volume, the top three purchaser countries in 2013 were China, Canada and Vietnam, which accounted for 22.58, 19.59 and 13.89 percent of the exports of U.S. white oak lumber, respectively.
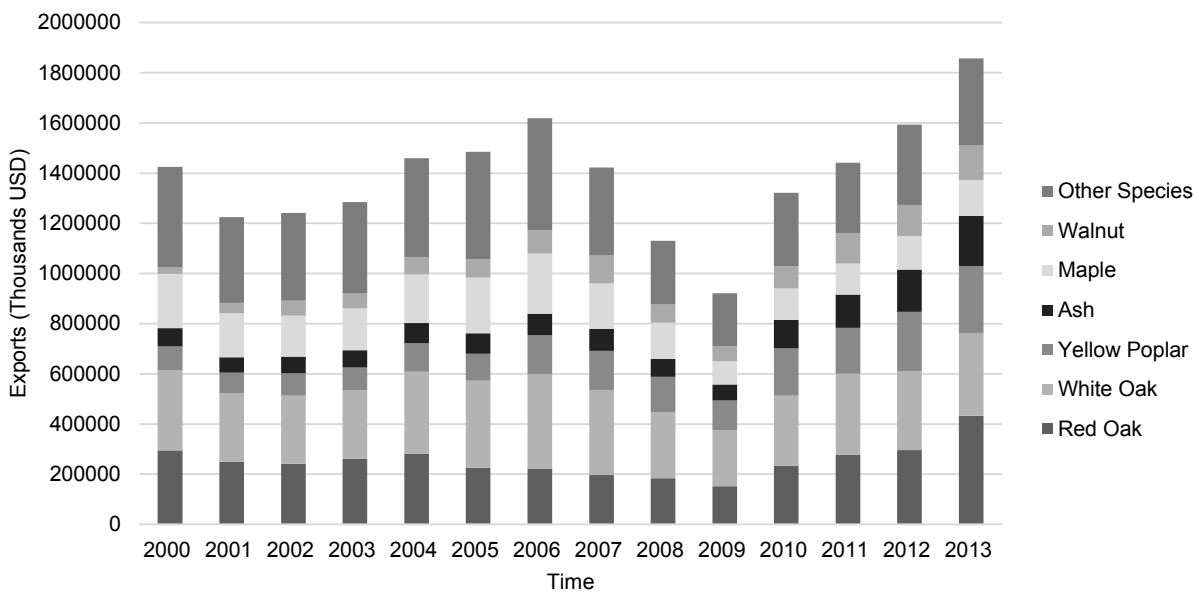
Figure 4.8 Exports of U.S. Hardwood Lumber by Species, 2000-2013 (FAS, 2014)

The market prices for one thousand Board Feet (MBF) of kiln-dried FAS white oak lumber (net tally) ranged from 1,845.00 to 2,935.00 USD in February 2014 (Figure 4.9), according to the Hardwood Market Review (HMR, 2014), depending on the thickness for plain-sawed lumber. In general, the four standard thicknesses included in this report, presented an average growth of 12 percent between January 2012 and February 2014. For instance, the price for kiln-dried FAS white oak in 4/4, increased approximately 18 percent in this time frame, with represents an absolute increment of 275 USD. In general, prices for FAS, 1 and 2 common have shown gradual increases

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between January 2012 and the first quarter of 2013. However, faster increase rates are observed, especially in 1 common 6/4 and 8/4, and 2 common for the same thicknesses. The other thicknesses, also started showing changes in the increase rate starting September 2013, and the trend continued during the first quarter of 2014.
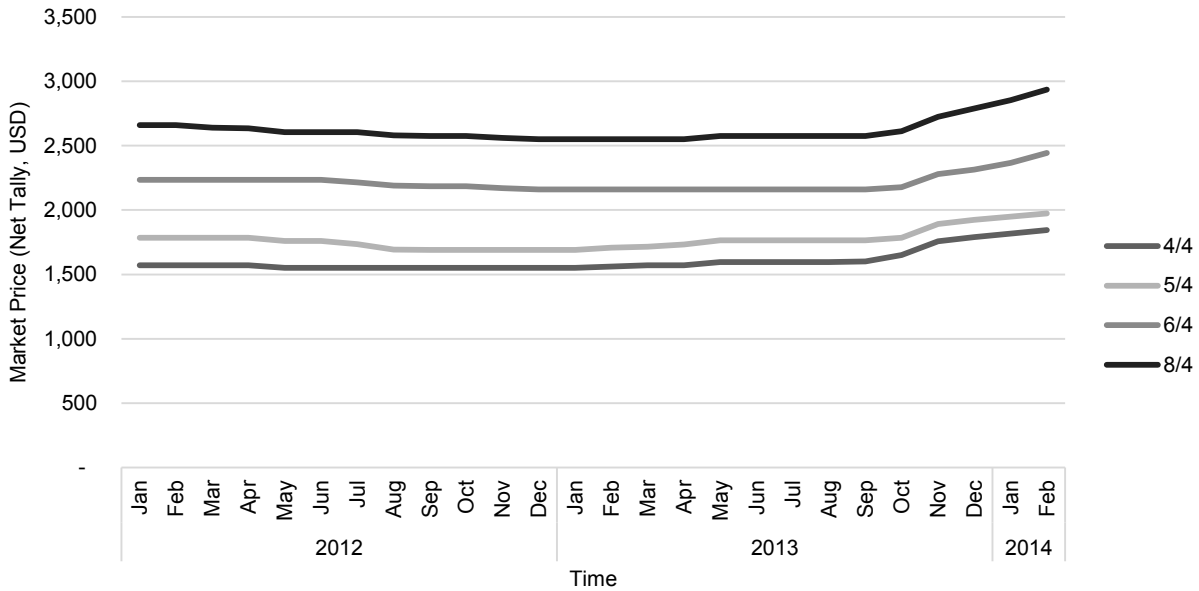
Figure 4.9 Market Prices by Thickness: White Oak FAS, 2012-2014 (HMR, 2014)

4.4.2.2   Comparison of Firm's Prices versus Market Prices

When compared against the market prices, for the January 2013 to February 2014 period, it was determined that Company A's prices are in average, 58 percent higher. In multiple instances, those prices were 99 percent higher, and the minimum difference found in available data, was of 27 percent. Moreover, when a linear correlation test was conducted between the company and market data, no strong linear association was found on any of the product configurations, but one. It is only for one product combination in a thickness of 5/4, that a strong, positive linear correlation was detected in the data, with a significance level –alpha, of 0.05.

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4.4.2.3 Demand versus Price Curve

The foundation of the basic price optimization approach, which is being suggested for the U.S. hardwood lumber industry in this study, is the modeling of the historical sales data provided by participating firms. In this stage of the project, researchers conducted multiple tests to find adequate *price-response* curves (*P-R*), to explain the relationship between pricing and demand, for each hardwood lumber product considered in this research. As it was explained in the literature review the *P-R* function needs to be nonnegative, continuous, differentiable and downward sloping. To facilitate the analysis and selection of the candidate products for further study, the researchers first selected those items that accounted for 85 percent of the export sales between 2012 and 2013. Then, they carried out exploratory data analyses (Tukey, 1977), where basic descriptive statistics and visual methods were utilized, according to the research design explained in the methodology section. Additionally, those products with 50 percent or more missing data for the 2012 to 2013 period, were discarded as unreliable. Out of the thirty-two white oak lumber products currently exported by company A, the resulting dataset consisted in the eleven items after applying these criteria.

Table 4.2 Correlation Analysis of Price vs. Demand: Company A

Product	Cut Type	Tally	Grade	Thickness	Pearson's Coefficient	p-value
A01	1	Net	3C	4/4	-.9226	.0004
A02	1	Net	1C	4/4	-.7815	.0076
A03	1	Net	FAS	6/4	-.5040	.0013
A04	1	Net	3C	7/4	-.3856	.0068
A05	1	Net	FAS	4/4	.0811	.5677
A06	1	Net	FAS	5/4	.2560	.0300
A07	1	Net	1C	6/4	.0543	.7167
A08	1	Net	1C	7/4	.3729	.0164
A09	1	Net	2C	4/4	-.1721	.4810
A10	1	Net	2C	6/4	NA	NA
A11	1	Net	2C	7/4	NA	NA

After studying the correlation and behavior of the individual data sets, the researchers decided to discard seven additional products either because no significant correlations were observed, or the same were positive, which conflicts with the requirement of downward sloping. The four remaining products (products A01 to A04 in Table 4.2) showed strong negative correlations for specific ranges of prices and demand, and were modeled using simple linear regression. As it can be observed in Table 4.3, the regression ANOVA table indicates that for product A1, the hypothesis test for the slope, has a p-value is 0.0028. Therefore the null hypothesis of the slope being equal to zero is rejected, since there is significant statistical evidence to suggest that the response variable (i.e. demand) is dependent on the explanatory variable (i.e. price) for orders below 10,000.00 BF. The coefficient of determination or r-square (Ott & Longnecker, 2010), also indicates that in average, the variable *price* explains 74.36 percent of the variation of the demand. The same null hypothesis was also rejected for product A2, with a p-value of 0.0076, an *alpha* of 0.05 and r-square of 0.6108. Similarly, for products A3 and A4, there is also sufficient statistical

evidence to suggest that shipping quantities are dependent on the net price, but contrary to the previous two cases, the coefficients of determination are 0.1049 and 0.1269 respectively, which indicates that the error in inferring the dependent variable, has only been decreased by 10.49% in product A3 and 12.69% in product A4, by incorporating the variable *price* in their models. Therefore, additional variables need to be included in these models to improve the inference error. For this reason, both products were not included further stages of this project, and researchers focused on products A1 and A2 solely. The resulting *price-response* curves, for Product A1 and A2 are respectively:

Product A1: $d_{A1} = 19232 - 27.59368 * p_{A1}$ (4-2)

Product A2: $d_{A2} = 50791 - 32.15238 * p_{A2}$ (4-3)

Table 4.3 Simple Linear Regression Product A1: ANOVA Table

Source of Error	DF	Sum of Squares	Mean Squares	*F*-Value	*p*-value
Model	1	57426492	57426492	20.3	0.0028
Error	7	19806179	2829454		
Total	8	77232671			

Table 4.4 Simple Linear Regression Product A2: ANOVA Table

Source of Error	DF	Sum of Squares	Mean Squares	*F*-Value	*p*-value
Model	1	4784654	4784654	12.55	0.0076
Error	8	3049172	381147		
Total	9	7833826			

4.4.2.4 Pricing Optimization

The total contribution *m*, which consists in the sum of the margins of the product for the period

between 2012 and 2014, and margin being the difference between the price *p* and incremental cost

c, can be modeled as following for a single product:

Total Contribution: $m = (p - c) * d(p)$ $\qquad$ (4-4)

Where:

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

$c = cost\ of\ lumber, in\ U.S.\ dollars\ per\ thousands\ of\ board\ feet\ (MBF)$

$d(p) = price - response\ function$

After incorporating the *P-R* functions of products A1 and A2 and substituting their costs (422.0

and 1155.0 USD per MBF) in equations (4-2) and (4-3)(4-3) respectively, the following equations

were obtained:

Product A1: $m_{A1} = (422.00 - p_{A1}) * (27.59 * p_{A1} - 19232.00)$ $\quad$ (4-5)

Product A2: $m_{A2} = (1155.00 - p_{A2}) * (32.15 * p_{A2} -$

$\qquad$ (4-6)

$50791.00)$

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Finding the optimal values for the total contribution curves (4-5) and (4-6) is an unconstrained optimization problem, and according to the theory (Hillier & Lieberman, 2010), it can be solved by taking the first partial derivative of m on p, equalize to zero, and solve for p. Through this procedure, it is found that optimal price p^* values for products A1 and A2 are 559.4818 and 1367.3482 USD per MBF, respectively.

4.4.3   Company B

4.4.3.1   Market Prices for U.S. Yellow Poplar Lumber

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 held in 2000, by substituting other species such as maple (Acer genus), represented 14.06 percent (266.7 million USD) of the total value of U.S. hardwood lumber exports in 2013, and 19.70 percent of the volume (288.1 million BF) for the same year (FAS, 2014). Also in terms of volume, 75.83 percent of the exports of U.S. yellow poplar lumber in 2013 were destined to Asia: 40.27 percent to East Asia, and 35.57 percent to Southeast Asia. The European Union and North America accounted for 13.00 and 8.97 percent of the same, respectively, and other geographic regions for the remaining 2.20 percent. In the same context, the top three importers of U.S. yellow poplar lumber were China, Vietnam and Mexico: with 36.44, 30.62 and 7.84 percent of the total value respectively (FAS, 2014).

As it was explained in the literature review and exemplified with white oak for company A (section 4.4.2), yellow poplar lumber is priced and traded depending on the grade, thickness and whether it is green or kiln dried - gross or net tally. The Figure 4.10 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; show 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 was 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.
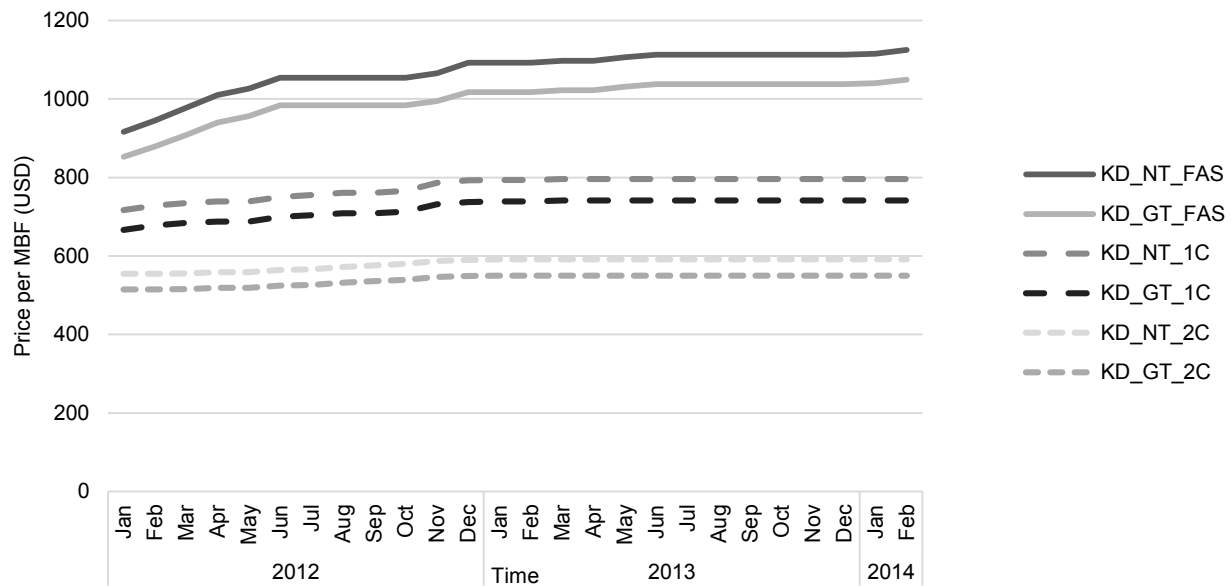
Figure 4.10 2013 Market Prices: Yellow Poplar Lumber

4.4.3.2   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 4.5, indicate that there is sufficient statistical evidence to suggest, that in 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 *1 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 4.5 Tests for means and variances: Market vs. Company B

Parameter	Test	Method	DF	Statistic Value	*p*-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

4.4.3.3   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 in section 4.4.2.3. As it has been depicted in Table 4.6, it was found that only one product met the requirements to proceed with the pricing modeling, whereas fifteen products were discarded due to the absence of negative linear correlation, and the other twelve products due to missing data above 50 percent.

Table 4.6 Correlation Analysis of Price vs. Demand: Company B

Product	Cut Type	Tally	Grade	Thickness	Pearson's Coefficient	p-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 (codenamed as product B1), only did so for a subset of the data. The original data set utilized for the exploratory data analysis of product B1, consisted in thirty-six sales orders, occurred in 2013. Pearson's correlation coefficient of this data set 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 in two 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 *alpha* of 0.05. The results of the linear regression analysis corresponding to product

B1, are depicted in Table 4.7, whereby it is found that the *price-response* curve is:

Product B1: $d_{B1} = 35597 - 29.126 * p_{B1}$ (4-7)

Table 4.7 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%. This indicates 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 will be used to explore the opportunities for optimization.

4.4.3.4 *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 (4-4), 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.

Product B1: $m_{B1} = (p_{B1} - 670) * (35597 - 29.126 * p_{B1})$ (4-8)

4.4.4   Demand Simulation

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.

4.4.4.1   Company A

Out of the potential distributions chosen to model the demand of product 1A in the exploratory

data analysis, it was found that a log normal distribution of mean 1244 BF and standard deviation

932.66 provides the best fit for the data. According to the Anderson-Darling test for goodness of

fit, it was found that the A^2 statistic is 0.647, which being smaller than the critical value of 0.752,

corresponding to a significance level *alpha* of 0.05, provides significant statistical to indicate that

the empirical distribution of the data corresponds to a normal distribution. The study of historic

sales, also helped the researchers determine that the pricing policies of Company A, can be

modeled through a second degree polynomial, as shown by equation (4-9), since it leads to a mean

absolute percentage error (MAPE) of 1.101% only.

Product A1: $p_{A1} = 1519.4 + 6.40t - 0.282t^2$ (4-9)

Where:

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

$t = time, in\ months$

The outcomes of the simulation of demand, optimization of prices, and forecasting of company A's pricing policies for the first quarter of 2014, are presented in Table 4.8. In order to simulate the demand, historic sales data were used to determine the probability distribution of monthly customer demand. For company A, it was determined that such demand follows a gamma distribution with alpha of *5160* and *beta* of 0.305 throughout 2013. A set of random numbers was generated using the middle-square method (Hayes, 1993), which in turn were imputed into the equation of the gamma distribution to generate simulated demand corresponding to the first quarter of 2014. Finally, individual profit margins were estimated using the prices obtained from both the proposed methodology based on optimization, and the current approach estimated via regression.

It was found that for this period, the prices based on the firm's current methodology, lead to higher revenue margins, than those obtained via the optimization model. In average, margins derived from the latter approach, are 44 percent greater than those expected from the former. The *t*-test explained previously in section 4.4.3.2, and conducted on the margins between the current and proposed methodologies for company A, revealed that with a *p*-value smaller than 0.0001, and a significance level *alpha* of 0.0500, there is sufficient statistical evidence to suggest that the mean of the margins corresponding to the suggested methodology, is lower than that from the current pricing policy for company A.

Table 4.8 Monte Carlo Simulation: Summary of Results, Company A

| Month | Year | Simulated Demand (BF) | Pricing Methodology | | | |
| | | | Current | | Proposed | |
			Price (USD)	Margin (USD)	Price (USD)	Margin (USD)
January	2014	1355.510	1578.12	429.52	1362.98	214.38
February	2014	1213.955	1560.00	411.40	1378.59	229.99
March	2014	3019.685	1564.13	405.66	1404.12	255.52

4.4.4.2   Company B

In the case of company B, it was determined that 2013 demand follows a log 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 .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 (4-10), given that the mean absolute percentage error (MAPE) amounts only 4.7 percent.

Product B1: $p_{B1} = 0.8609 + 0.0358t - 0.001819t^2$ (4-10)

Where:

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

$t = time, in\ months$

The Table 4.9 depicts the simulated demand and pricing policies, which were estimated following the same approach described for company A. The average of optimized price given by the model is 960 USD per MBF and the predicted prices average is 861 USD per MBF. The standard deviation for the optimized prices is 20.4 USD per MBF and the standard deviation for the predicted prices is 70.6 USD per MBF. This suggests that the deviation of the predicted prices, it means, those 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 4.9 Monte Carlo Simulation: Summary of Results, Company B

| Month | Year | Simulated Demand (BF) | Pricing Methodology | | | |
| | | | Current | | Proposed | |
			Price (USD)	Margin (USD)	Price (USD)	Margin (USD)
January	2014	10867.05	929.00	251.00	951.00	273.00
February	2014	6089.30	865.00	188.00	945.00	267.00
March	2014	5105.10	788.00	110.00	983.00	305.00

The contribution margin obtained from the optimal price and the predicted price are also shown in Table 4.9. According to the validation strategy proposed for 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. Conducting a *t*-test on the margins between the current and proposed methodologies, it was found that with a *p*-value 0.0404, and a significance level *alpha* of 0.0500, there is sufficient statistical evidence to suggest that the mean of the margins corresponding to the suggested methodology, is higher than that from the current pricing policy for company B.

4.5   Discussion

Characteristics of U.S. Harwood Lumber Demand

The data analysis conducted in phases one and two of this study, revealed that a significant portion of the cases, showed upward slopes in their respective *P-R* curves. The majority of products with significant linear correlation, shows positives values for the Pearson's or Spearman's coefficients. These results indicate a trend on the behavior of hardwood lumber products for the sample selected

in this case study. 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 shown supported the notion that, consumer's income and the substitution effect favor the increase consumption when the price rises (Lancaster, 1966), later studies on the topic suggest that at aggregate level, and under certain conditions, the law of demand will hold (Hildenbrand, 1983; Lancaster, 1966).

It was been 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, this statement entails that conditions prevailing at the firm level, may also, drive a behavior in demand characterized by upward slopes

The exploratory data analysis performed in this study, served as a basis to recognize that for some of the cases, it is possible to extract "portions" of the demand, in which the down-ward 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. General, 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 summarized in Table 4.1, 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.

The prices obtained through the optimization procedure, proved to be statistically lower than those coming from participating firm A. It is interesting to observe that the variations in the historical prices of the cases studied in these firms, were in general small. For instance, product A1, has a coefficient of variation of 2.83 percent, 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 ε, 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 4.10, 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 4.10 Price-point Elasticity's: Product A1

Point	Price	Elasticity (ε)
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 it 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. As such, the optimization model used reacted faster to the

changes in the simulated demand kept prices at higher level and therefore led to higher revenue margins that the current methodology.

4.6   Conclusions

The purpose of this research project is 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. This is partially so because the project focused on products with linear relationships. It is also because the majority of the products depicted a positive relationship between price and demand. In other words, the demand of these products increased with the price, and such behavior is considered an exception to the law of demand. Even though it was found that market pricing is a bad predictor for those of the firms', it is interesting to observe that growth over time is not as pronounced at the industry level, which may indicate that either companies selected for this study are special chases, or that modeling process needs to be conducted for aggregated product families, rather than by individual products. Therefore there is an opportunity for further studies in demand characterization for the hardwood industry.

The optimization process presented mixed results, which may serve as an indication that not all hardwood products and markets may be suitable for this approach, or that the nature of the demand

for such products is by default, nonlinear. Another aspect to consider is that in the export business, U.S. companies tend deal with a smaller base of customers, therefore, the demand data would be strongly influenced by the contractual conditions established for these, which suggests that pricing optimization might be put for better use in context where the customer base is wider, and the effects of special agreements with customers are minimized, or even cancelled out when demand is averaged. For this reason, further research is recommended not only for products 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.

4.7   References

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5 Conclusions, Implications, and Limitations of the Study

5.1 Conclusions

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. The goal of this research is to identify opportunities to increase the *export performance* of U.S. hardwood firms in Asia and Western Europe, by identifying its determinant factors and developing alternative approaches to manage key aspects of the business such as pricing.

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.

5.1.1 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 o*rder 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. p*roduct 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*, and *delivery lead time*, among others.

5.1.2   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 percent 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.

5.1.3 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 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

5.2 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 5.1 depicts some of the critical value added factors discussed throughout this document, and offers a perspective on the practical application of the same.
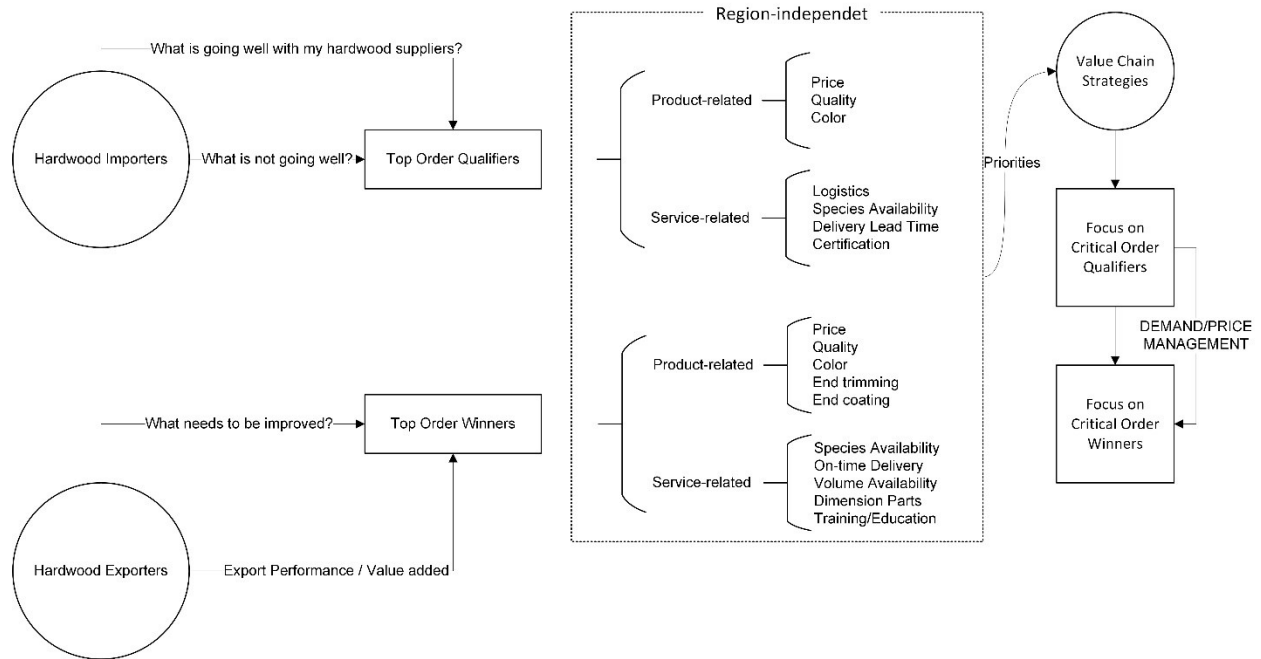
Figure 5.1 Value chain strategies

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 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, regression analysis needs to be carried out, with special attention to strength of the relationship between both variables (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

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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

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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.

5.3   Implications

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, it 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.

5.4   Future Research

In the forest products industry in general, supply chains involve a complex array stakeholders and of flows of information and resources. The main goal of operations research in general, and Process Simulation in particular, is to establish mechanisms to optimize and procure and the necessary resources for the company to satisfy the needs of the market in accordance with its specific goals, this involves aspects such as closing or opening new business units, investing in new technologies, developing new products and markets, determining planning strategies and inventory locations. The process of optimizing resources (e.g. production capacity, warehouse space, transportation fleet capacity, workforce availability, financial resources, etc.) is fairly complex, more especially when it involves multiple production, storage and distribution facilities, and supply chain stakeholders. In the forest products industry, Process Simulation and Modeling offer an alternative to face the complexity of integrating and executing these tasks through developing integrated Decision Support System (DSS) that can optimize the entire supply chain and not just a single or few links of it via mathematical modeling. Mathematical programing is

not new for the forest products industry. Previous research has been done in different stages of wood fiber supply chains: Forestry, Pulp and Paper, Lumber, Panel and Engineered Wood Products and Biofuels. In the Engineered Wood Products supply chain, several studies have taken place on specific areas of supply chain planning and mainly focused on lumber and OSB manufacturing. However, the implementation of such approaches is still in its early stages for most of the industry, which represents an important opportunity for contributing to the economic development of the industry and the business literature in general. Hence, there is potential for innovation in the Forest Products Industry. This sector, and the wood industry in particular, 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 of the efforts of US 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: lead-times, on-time delivery, transportations costs, among others; where the tools provided by operations research, managing science and supply chain management by serve to improve the industry's competitiveness.

Appendix A.   IRB APPROVAL LETTER

VirginiaTech

Office of Research Compliance
Institutational Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE:	August 5, 2013
TO:	Henry Jose Quesada Pineda, Edgar Arias Blanco
FROM:	Virginia Tech Institutional Review Board (FWA00000572, expires April 25, 2018)
PROTOCOL TITLE:	Analysis of Factors Impacting the International Value Chain of Hardwood Products: A Comparion between Asia and Western Europe
IRB NUMBER:	11-1073

Effective August 5, 2013, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	Expedited, under 45 CFR 46.110 category(ies) 7
Protocol Approval Date:	**August 5, 2013**
Protocol Expiration Date:	**August 4, 2014**
Continuing Review Due Date*:	**July 21, 2014**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

Appendix B.   PHASE 1, QUESTIONNAIRE

⬚ VirginiaTech
College of Natural Resources
and Environment

Department of Sustainable Biomaterials
Brooks Center (0503), 1650 Research Center Drive
Blacksburg, Virginia 24061
www.sbio.vt.edu

Questionnaire

Exports of US Hardwood Products: Increasing Performance in Asia and Western Europe

The purpose of this survey is to identify opportunities to improve U.S. Hardwood suppliers' performance in international markets.

The data collected and posterior analysis and results will remain confidential and only used in this study (including related reports).

The identity of the respondent and respondent's firms will remain undisclosed in any publication resulting from this study. This research is being conducted by Edgar Arias, Graduate Research assistant and PhD student in the Department of Sustainable Biomaterials at Virginia Tech (Virginia, United States).

If you have any questions, please contact Edgar Arias by email at earias@vt.edu or by phone at 1-540-231-5219.

1. Does your company import hardwood products from other countries?
    ⬚Yes (Continue to next question) (1)
    ⬚No (End of survey) (2)

2. What is your job position?

3. In what country is your company located?

4. What country is your firm's major provider of hardwood products?

5. What are the top 3 hardwood species imported from your major provider country?

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6. What hardwood products are predominantly imported from your major provider country?

☐ Dimension Lumber (1)
☐ Finished Products (furniture, cabinets, doors, etc.) (2)
☐ Flooring (3)
☐ Hardwood Plywood (4)
☐ Logs (5)
☐ Lumber (6)
☐ Moulding (7)
☐ Veneer (8)
☐ Other (9) _____

7. Which factors are of concern to your firm in the selection of your main hardwood supplier?

8. What barriers or road blocks does your firm face while dealing with your main hardwood supplier? (Top 3)

9. From your perspective, what can hardwood suppliers do to increase the value of their products and services?

End of Survey

Thank you for your help. Again, this information will be kept confidential. If you have any questions, please contact Edgar Arias by email at earias@vt.edu or by phone at 1-540-231-5219.

Appendix C.   PHASE 2, QUESTIONNAIRE

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
___ %	___ %	___ %	___ %	___ %	___ %	___ %	___ %	100%

   ▶ 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
___ %	___ %	___ %	___ %	___ %	___ %	100%

   ▶ 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
___ %	___ %	___ %	___ %	___ %	___ %	___ %	___ %	___ %	___ %	___ %	100%

   ▶ If Other(s). Please indicate the species: _____

8. What are your company's plans to grow in Asia? *Please select all alternatives that apply.*

☐ Increase promotion and advertising

☐ Offer more competitive prices than competition

☐ Introduce product's new features

☐ Other. Please indicate: [   ]

9. What are your company's plans to increase profits in Asia? *Please select all alternatives that apply.*

☐ Reduce manufacturing costs

☐ Reduce promotion and advertising costs

☐ Reduce transportation costs

☐ Improve prices

☐ Increase productivity

☐ Other. Please indicate: [   ]

10. Please rate how important the following value-added opportunities are to your customers in Asia.

Opportunities to add value	Not Important at All	Low Importance	Slightly Important	Neutral	Moderately Important	Very Important	Extremely Important
	1	2	3	4	5	6	7
Improve product quality	O	O	O	O	O	O	O
Improve package quality	O	O	O	O	O	O	O
Faster product delivery	O	O	O	O	O	O	O
Improve on-time delivery	O	O	O	O	O	O	O
Improve customer service	O	O	O	O	O	O	O
Offer SFI or FSC certified products	O	O	O	O	O	O	O
Improve volume availability	O	O	O	O	O	O	O
Improve mix of species availability	O	O	O	O	O	O	O
Offer custom planing	O	O	O	O	O	O	O
Offer custom packaging	O	O	O	O	O	O	O
Offer end-coating	O	O	O	O	O	O	O
Offer end-trimming	O	O	O	O	O	O	O
Offer pre-surfacing	O	O	O	O	O	O	O
Offer custom grading	O	O	O	O	O	O	O
Offer dimension parts	O	O	O	O	O	O	O
Offer color sorting	O	O	O	O	O	O	O

11. Please rate the importance of the following socio-cultural characteristics of Asian markets on your company's export performance.

Socio-cultural	Not Important at All	Low Importance	Slightly Important	Neutral	Moderately Important	Very Important	Extremely Important
	1	2	3	4	5	6	7
Customs and traditions	O	O	O	O	O	O	O
Religion	O	O	O	O	O	O	O
Education level	O	O	O	O	O	O	O
Values, beliefs, attitudes	O	O	O	O	O	O	O
Business ethics	O	O	O	O	O	O	O
Language	O	O	O	O	O	O	O

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

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

Exporting to Europe

13. Does your company export hardwood lumber to Europe?
   - O Yes (*proceed to question 14*)
   - O 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
   [   ] %   [   ] %   [   ] %   [   ] %   [   ] %   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
   [   ] %   [   ] %   [   ] %   [   ] %   [   ] %   [   ] %   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
   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   [ ] %   100%

   ▶ If Other(s). Please indicate the species: [   ]

Marketing in Europe

19. What are your company's plans to grow in Europe? *Please select all alternatives that apply.*
    - ☐ Increase promotion and advertising
    - ☐ Offer more competitive prices than competition
    - ☐ Introduce product's new features
    - ☐ Other. Please indicate: _____

20. What are your company's plans to increase profits in Europe? *Please select all the alternatives that apply.*
    - ☐ Reduce manufacturing costs
    - ☐ Reduce promotion and advertising costs
    - ☐ Reduce transportation costs
    - ☐ Improve prices
    - ☐ Increase productivity
    - ☐ Other. Please indicate: _____

21. Please rate how <u>important</u> the following <u>value-added opportunities</u> are to your customers in <u>Europe</u>.

Opportunities to add value	Not Important at All	Low Importance	Slightly Important	Neutral	Moderately Important	Very Important	Extremely Important
	1	2	3	4	5	6	7
Improve product quality	O	O	O	O	O	O	O
Improve package quality	O	O	O	O	O	O	O
Faster product delivery	O	O	O	O	O	O	O
Improve on-time delivery	O	O	O	O	O	O	O
Improve customer service	O	O	O	O	O	O	O
Offer SFI or FSC certified products	O	O	O	O	O	O	O
Improve volume availability	O	O	O	O	O	O	O
Improve mix of species availability	O	O	O	O	O	O	O
Offer custom planing	O	O	O	O	O	O	O
Offer custom packaging	O	O	O	O	O	O	O
Offer end-coating	O	O	O	O	O	O	O
Offer end-trimming	O	O	O	O	O	O	O
Offer pre-surfacing	O	O	O	O	O	O	O
Offer custom grading	O	O	O	O	O	O	O
Offer dimension	O	O	O	O	O	O	O
Offer color sorting	O	O	O	O	O	O	O

22. Please rate the <u>importance</u> of the following <u>socio-cultural</u> characteristics of <u>European</u> markets on your company's export performance.

Socio-cultural	Not Important at All	Low Importance	Slightly Important	Neutral	Moderately Important	Very Important	Extremely Important
	1	2	3	4	5	6	7
Customs and traditions	O	O	O	O	O	O	O
Religion	O	O	O	O	O	O	O
Education level	O	O	O	O	O	O	O
Values, beliefs, attitudes	O	O	O	O	O	O	O
Business ethics	O	O	O	O	O	O	O
Language	O	O	O	O	O	O	O

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

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

General

24. Indicate if you agree or disagree that the following efforts have been valuable in increasing your company's export performance.

Efforts	Strongly Disagree 1	Disagree 2	Somewhat Disagree 3	Neutral 4	Somewhat Agree 5	Agree 6	Strongly Agree 7
Assistance from State Dept. of Commerce	O	O	O	O	O	O	O
Assistance from Foreign government agencies	O	O	O	O	O	O	O
Assistance from University Extension Programs	O	O	O	O	O	O	O
Domestic Trade Shows	O	O	O	O	O	O	O
Overseas Trade Shows	O	O	O	O	O	O	O
Assistance from USDA	O	O	O	O	O	O	O
Assistance from trade associations (e.g. NHLA, AHEC, etc.)	O	O	O	O	O	O	O
Other. Please indicate:	O	O	O	O	O	O	O

Export Performance

25. What were your company's export 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	
	O	O	O	O	O	O	O	O

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

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

27. What was your company's export profit in 2012? *Please select the range that better approximates your sales in U.S. dollars.*

0 to 1,000,000	1,000,001 to 5,000,000	5,000,001 to 10,000,000	10,000,001 to 20,000,000	20,000,001 to 30,000,000	30,000,001 to 40,000,000	40,000,001 to 50,000,000	50,000,001 Or more
O	O	O	O	O	O	O	O

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	
	○	○	○	○	○	○	○	○

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: [   ]

Appendix D.   Phase 2, List of Variables

Question	Survey Section	Var ID	Factor	Variable Label	Description
01	General_Information	Q01	-	Firm_Export_Status	Yes/No
31	Gen_Charac_Compan	Q31	-	Firm_Year_of_Establishent	
32	Gen_Charac_Compan	Q32	-	Firm_Num_Employees	
33	Gen_Charac_Compan	Q33	-	Firm_Num_Sawmills	Number of sawmills in U.S.
35	Gen_Charac_Compan	Q35	-	Firm_Domestic_Sales_2012	
34	Gen_Charac_Compan	Q34	-	Firm_Num_EE_SNM_Domestic	Number of Employees
02	Exporting_to_Asia	Q02	-	Asia_Hardwood_Exporter	
03	Exporting_to_Asia	Q03	-	Asia_Exp_First_Year	
04	Exporting_to_Asia	Q04_1	-	Asia_Exp_Country_China	China
04	Exporting_to_Asia	Q04_2	-	Asia_Exp_Country_Vietnam	Vietnam
04	Exporting_to_Asia	Q04_3	-	Asia_Exp_Country_Thailand	Thailand
04	Exporting_to_Asia	Q04_4	-	Asia_Exp_Country_Japan	Japan
04	Exporting_to_Asia	Q04_5	-	Asia_Exp_Country_India	India
04	Exporting_to_Asia	Q04_6	-	Asia_Exp_Country_Indonesia	Indonesia
04	Exporting_to_Asia	Q04_7	-	Asia_Exp_Country_South Korea	South Korea
04	Exporting_to_Asia	Q04_8	-	Asia_Exp_Country_Others1	Others. Please indicate:
05	Exporting_to_Asia	Q05_1	-	Asia_Exp_Product_Flooring	Flooring
05	Exporting_to_Asia	Q05_2	-	Asia_Exp_Product_Furniture	Furniture
05	Exporting_to_Asia	Q05_3	-	Asia_Exp_Product_Millwork	Millwork
05	Exporting_to_Asia	Q05_4	-	Asia_Exp_Product_Cabinet	Cabinet
05	Exporting_to_Asia	Q05_5	-	Asia_Exp_Product_Pallet	Pallet
05	Exporting_to_Asia	Q05_6	-	Asia_Exp_Product_Others1	Others. Please Indicate
06	Exporting_to_Asia	Q06_1	-	Asia_Exp_Channel_1	They contact our U.S. offices directly
06	Exporting_to_Asia	Q06_2	-	Asia_Exp_Channel_2	Through our own affiliate located in Asia
06	Exporting_to_Asia	Q06_3	-	Asia_Exp_Channel_3	They contact a wholesaler located in Asia
06	Exporting_to_Asia	Q06_4	-	Asia_Exp_Channel_4	Through a wholesaler located in the U.S.

Question	Survey Section	Var ID	Factor	Variable Label	Description
06	Exporting_to_Asia	Q06_5	-	Asia_Exp_Channel_5	Other. Please indicate:
07	Exporting_to_Asia	Q07_1	-	Asia_Exp_Species_Ash	Ash
07	Exporting_to_Asia	Q07_2	-	Asia_Exp_Species_Beech	Beech
07	Exporting_to_Asia	Q07_3	-	Asia_Exp_Species_Basswood	Basswood
07	Exporting_to_Asia	Q07_4	-	Asia_Exp_Species_Cherry	Cherry
07	Exporting_to_Asia	Q07_5	-	Asia_Exp_Species_Hickory	Hickory
07	Exporting_to_Asia	Q07_6	-	Asia_Exp_Species_Maple	Maple
07	Exporting_to_Asia	Q07_7	-	Asia_Exp_Species_Red Oak	Red Oak
07	Exporting_to_Asia	Q07_8	-	Asia_Exp_Species_Walnut	Walnut
07	Exporting_to_Asia	Q07_9	-	Asia_Exp_Species_White Oak	White Oak
07	Exporting_to_Asia	Q07_10	-	Asia_Exp_Species_Yellow Poplar	Yellow Poplar
07	Exporting_to_Asia	Q07_11	-	Asia_Exp_Species_Other1	Other. Please indicate:
08	Marketing_in_Asia	Q08_1	-	Asia_Exp_Growth_Obj_1	Increase promotion and advertising
08	Marketing_in_Asia	Q08_2	-	Asia_Exp_Growth_Obj_2	Offer more competitive prices than competition
08	Marketing_in_Asia	Q08_3	-	Asia_Exp_Growth_Obj_3	Introduce product's new features
08	Marketing_in_Asia	Q08_4	-	Asia_Exp_Growth_Obj_4	Other. Please indicate:
09	Marketing_in_Asia	Q09_1	-	Asia_Exp_Profit_Obj_1	Reduce manufacturing costs
09	Marketing_in_Asia	Q09_2	-	Asia_Exp_Profit_Obj_2	Reduce promotion and advertising costs
09	Marketing_in_Asia	Q09_3	-	Asia_Exp_Profit_Obj_3	Reduce transportation costs
09	Marketing_in_Asia	Q09_4	-	Asia_Exp_Profit_Obj_4	Improve prices
09	Marketing_in_Asia	Q09_5	-	Asia_Exp_Profit_Obj_5	Increase productivity
09	Marketing_in_Asia	Q09_6	-	Asia_Exp_Profit_Obj_6	Other. Please indicate:
10	Marketing_in_Asia	Q10_1	Product/Service	Asia_Exp_Order_1	Improve product quality
10	Marketing_in_Asia	Q10_2	Product/Service	Asia_Exp_Order_2	Improve package quality
10	Marketing_in_Asia	Q10_3	Product/Service	Asia_Exp_Order_3	Faster product delivery
10	Marketing_in_Asia	Q10_4	Product/Service	Asia_Exp_Order_4	Improve on-time delivery
10	Marketing_in_Asia	Q10_5	Product/Service	Asia_Exp_Order_5	Improve customer service
10	Marketing_in_Asia	Q10_6	Product/Service	Asia_Exp_Order_6	Offer SFI or FSC certified products

Question	Survey Section	Var ID	Factor	Variable Label	Description
10	Marketing_in_Asia	Q10_7	Product/Service	Asia_Exp_Order_7	Improve volume availability
10	Marketing_in_Asia	Q10_8	Product/Service	Asia_Exp_Order_8	Improve mix of species availability
10	Marketing_in_Asia	Q10_9	Product/Service	Asia_Exp_Order_9	Offer custom planing
10	Marketing_in_Asia	Q10_10	Product/Service	Asia_Exp_Order_10	Offer end-coating
10	Marketing_in_Asia	Q10_11	Product/Service	Asia_Exp_Order_11	Offer custom packaging
10	Marketing_in_Asia	Q10_12	Product/Service	Asia_Exp_Order_12	Offer end-trimming
10	Marketing_in_Asia	Q10_13	Product/Service	Asia_Exp_Order_13	Offer pre-surfacing
10	Marketing_in_Asia	Q10_14	Product/Service	Asia_Exp_Order_14	Offer custom grading
10	Marketing_in_Asia	Q10_15	Product/Service	Asia_Exp_Order_15	Offer dimension parts
10	Marketing_in_Asia	Q10_16	Product/Service	Asia_Exp_Order_16	Offer color sorting
11	Marketing_in_Asia	Q11_1	Socio-Cultural	Asia_Exp_Soc_Cul_Char_1	Customs and traditions
11	Marketing_in_Asia	Q11_2	Socio-Cultural	Asia_Exp_Soc_Cul_Char_2	Religion
11	Marketing_in_Asia	Q11_3	Socio-Cultural	Asia_Exp_Soc_Cul_Char_3	Education level
11	Marketing_in_Asia	Q11_4	Socio-Cultural	Asia_Exp_Soc_Cul_Char_4	Values, beliefs, attitudes
11	Marketing_in_Asia	Q11_5	Socio-Cultural	Asia_Exp_Soc_Cul_Char_5	Business ethics
11	Marketing_in_Asia	Q11_6	Socio-Cultural	Asia_Exp_Soc_Cul_Char_6	Language
12	Marketing_in_Asia	Q12_1	Political-regulatory	Asia_Exp_Polit_Reg_Char_1	Political stability
12	Marketing_in_Asia	Q12_2	Political-regulatory	Asia_Exp_Polit_Reg_Char_2	Political system/ideology
12	Marketing_in_Asia	Q12_3	Political-regulatory	Asia_Exp_Polit_Reg_Char_3	Business/marketing regulatory system
12	Marketing_in_Asia	Q12_4	Political-regulatory	Asia_Exp_Polit_Reg_Char_4	Government attitude toward foreign business
12	Marketing_in_Asia	Q12_5	Political-regulatory	Asia_Exp_Polit_Reg_Char_5	Government controls/protectionism

Question	Survey Section	Var ID	Factor	Variable Label	Description
12	Marketing_in_Asia	Q12_6	Political-regulatory	Asia_Exp_Polit_Reg_Char_6	Bureaucracy
12	Marketing_in_Asia	Q12_7	Political-regulatory	Asia_Exp_Polit_Reg_Char_7	Business/intellectual right protection
12	Marketing_in_Asia	Q12_8	Political-regulatory	Asia_Exp_Polit_Reg_Char_8	International association/ organization membership
12	Marketing_in_Asia	Q12_9	Political-regulatory	Asia_Exp_Polit_Reg_Char_9	Government foreign policy
13	Exporting_to_EU	Q13	-	EU_Hardwood_Exporter	Yes / No
14	Exporting_to_EU	Q14	-	UE_Exp_First_Year	
15	Exporting_to_EU	Q15_1	-	EU_Exp_Country_Italy	Italy
15	Exporting_to_EU	Q15_2	-	EU_Exp_Country_United Kingdom	United Kingdom
15	Exporting_to_EU	Q15_3	-	EU_Exp_Country_Germany	Germany
15	Exporting_to_EU	Q15_4	-	EU_Exp_Country_Spain	Spain
15	Exporting_to_EU	Q15_5	-	EU_Exp_Country_Others1	Others. Please indicate:
16	Exporting_to_EU	Q16_1	-	EU_Exp_Product_Flooring	Flooring
16	Exporting_to_EU	Q16_2	-	EU_Exp_Product_Furniture	Furniture
16	Exporting_to_EU	Q16_3	-	EU_Exp_Product_Millwork	Millwork
16	Exporting_to_EU	Q16_4	-	EU_Exp_Product_Cabinet	Cabinet
16	Exporting_to_EU	Q16_5	-	EU_Exp_Product_Pallet	Pallet
16	Exporting_to_EU	Q16_6	-	EU_Exp_Product_Others1	Others. Please Indicate
17	Exporting_to_EU	Q17_1	-	EU_Exp_Channel_1	They contact our U.S. offices directly
17	Exporting_to_EU	Q17_2	-	EU_Exp_Channel_2	Through our own affiliate located in Europe
17	Exporting_to_EU	Q17_3	-	EU_Exp_Channel_3	They contact a wholesaler located in Europe
17	Exporting_to_EU	Q17_4	-	EU_Exp_Channel_4	Through a wholesaler located in the U.S.
17	Exporting_to_EU	Q17_5	-	EU_Exp_Channel_5	Other. Please indicate:
18	Exporting_to_EU	Q18_1	-	EU_Exp_Species_Ash	Ash
18	Exporting_to_EU	Q18_2	-	EU_Exp_Species_Beech	Beech
18	Exporting_to_EU	Q18_3	-	EU_Exp_Species_Basswood	Basswood
18	Exporting_to_EU	Q18_4	-	EU_Exp_Species_Cherry	Cherry

Question	Survey Section	Var ID	Factor	Variable Label	Description
18	Exporting_to_EU	Q18_5	-	EU_Exp_Species_Hickory	Hickory
18	Exporting_to_EU	Q18_6	-	EU_Exp_Species_Maple	Maple
18	Exporting_to_EU	Q18_7	-	EU_Exp_Species_Red Oak	Red Oak
18	Exporting_to_EU	Q18_8	-	EU_Exp_Species_Walnut	Walnut
18	Exporting_to_EU	Q18_9	-	EU_Exp_Species_White Oak	White Oak
18	Exporting_to_EU	Q18_10	-	EU_Exp_Species_Yellow Poplar	Yellow Poplar
18	Exporting_to_EU	Q18_11	-	EU_Exp_Species_Other1	Other. Please indicate:
19	Marketing_in_EU	Q19_1	-	EU_Exp_Growth_Obj_1	Increase promotion and advertising
19	Marketing_in_EU	Q19_2	-	EU_Exp_Growth_Obj_2	Offer more competitive prices than competition
19	Marketing_in_EU	Q19_3	-	EU_Exp_Growth_Obj_3	Introduce product's new features
19	Marketing_in_EU	Q19_4	-	EU_Exp_Growth_Obj_4	Other. Please indicate:
20	Marketing_in_EU	Q20_1	-	EU_Exp_Profit_Obj_1	Reduce manufacturing costs
20	Marketing_in_EU	Q20_2	-	EU_Exp_Profit_Obj_2	Reduce promotion and advertising costs
20	Marketing_in_EU	Q20_3	-	EU_Exp_Profit_Obj_3	Reduce transportation costs
20	Marketing_in_EU	Q20_4	-	EU_Exp_Profit_Obj_4	Improve prices
20	Marketing_in_EU	Q20_5	-	EU_Exp_Profit_Obj_5	Increase productivity
20	Marketing_in_EU	Q20_6	-	EU_Exp_Profit_Obj_6	Other. Please indicate:
21	Marketing_in_EU	Q21_1	Product/Service	EU_Exp_Order_1	Improve product quality
21	Marketing_in_EU	Q21_2	Product/Service	EU_Exp_Order_2	Improve package quality
21	Marketing_in_EU	Q21_3	Product/Service	EU_Exp_Order_3	Faster product delivery
21	Marketing_in_EU	Q21_4	Product/Service	EU_Exp_Order_4	Improve on-time delivery
21	Marketing_in_EU	Q21_5	Product/Service	EU_Exp_Order_5	Improve customer service
21	Marketing_in_EU	Q21_6	Product/Service	EU_Exp_Order_6	Offer SFI or FSC certified products
21	Marketing_in_EU	Q21_7	Product/Service	EU_Exp_Order_7	Improve volume availability
21	Marketing_in_EU	Q21_8	Product/Service	EU_Exp_Order_8	Improve mix of species availability
21	Marketing_in_EU	Q21_9	Product/Service	EU_Exp_Order_9	Offer custom planing
21	Marketing_in_EU	Q21_10	Product/Service	EU_Exp_Order_10	Offer end-coating

Question	Survey Section	Var ID	Factor	Variable Label	Description
21	Marketing_in_EU	Q21_1_1	Product/Service	EU_Exp_Order_11	Offer custom packaging
21	Marketing_in_EU	Q21_1_2	Product/Service	EU_Exp_Order_12	Offer end-trimming
21	Marketing_in_EU	Q21_1_3	Product/Service	EU_Exp_Order_13	Offer pre-surfacing
21	Marketing_in_EU	Q21_1_4	Product/Service	EU_Exp_Order_14	Offer custom grading
21	Marketing_in_EU	Q21_1_5	Product/Service	EU_Exp_Order_15	Offer custom dimensioning
21	Marketing_in_EU	Q21_1_6	Product/Service	EU_Exp_Order_16	Offer color sorting
22	Marketing_in_EU	Q22_1	Socio-Cultural	EU_Exp_Soc_Cul_Char_1	Customs and traditions
22	Marketing_in_EU	Q22_2	Socio-Cultural	EU_Exp_Soc_Cul_Char_2	Religion
22	Marketing_in_EU	Q22_3	Socio-Cultural	EU_Exp_Soc_Cul_Char_3	Education level
22	Marketing_in_EU	Q22_4	Socio-Cultural	EU_Exp_Soc_Cul_Char_4	Values, beliefs, attitudes
22	Marketing_in_EU	Q22_5	Socio-Cultural	EU_Exp_Soc_Cul_Char_5	Business ethics
22	Marketing_in_EU	Q22_6	Socio-Cultural	EU_Exp_Soc_Cul_Char_6	Language
23	Marketing_in_EU	Q23_1	Political-regulatory	EU_Exp_Polit_Reg_Char_1	Political stability
23	Marketing_in_EU	Q23_2	Political-regulatory	EU_Exp_Polit_Reg_Char_2	Political system/ideology
23	Marketing_in_EU	Q23_3	Political-regulatory	EU_Exp_Polit_Reg_Char_3	Business/marketing regulatory system
23	Marketing_in_EU	Q23_4	Political-regulatory	EU_Exp_Polit_Reg_Char_4	Government attitude toward foreign business
23	Marketing_in_EU	Q23_5	Political-regulatory	EU_Exp_Polit_Reg_Char_5	Government controls/protectionism
23	Marketing_in_EU	Q23_6	Political-regulatory	EU_Exp_Polit_Reg_Char_6	Bureaucracy
23	Marketing_in_EU	Q23_7	Political-regulatory	EU_Exp_Polit_Reg_Char_7	Business/intellectual right protection
23	Marketing_in_EU	Q23_8	Political-regulatory	EU_Exp_Polit_Reg_Char_8	International association/ organization membership

Question	Survey Section	Var ID	Factor	Variable Label	Description
23	Marketing_in_EU	Q23_9	Political-regulatory	EU_Exp_Polit_Reg_Char_9	Government foreign policy
24	Export_Performance	Q24_1	Support	Exp_Support_Effort_1	Assistance from State Dept. of Commerce
24	Export_Performance	Q24_2	Support	Exp_Support_Effort_2	Assistance from Foreign government agencies
24	Export_Performance	Q24_3	Support	Exp_Support_Effort_3	Assistance from University Extension Programs
24	Export_Performance	Q24_4	Support	Exp_Support_Effort_4	Domestic Trade Shows
24	Export_Performance	Q24_5	Support	Exp_Support_Effort_5	Overseas Trade Shows
24	Export_Performance	Q24_6	Support	Exp_Support_Effort_6	Assistance from USDA
24	Export_Performance	Q24_7	Support	Exp_Support_Effort_7	Assistance from trade associations (e.g. NHLA, AHEC, etc.)
24	Export_Performance	Q24_8	Support	Exp_Support_Effort_8	Other. Please indicate:
25	Export_Performance	Q25	-	Exp_Sales_2012	
26	Export_Performance	Q26	-	Exp_Sales_2012_Increase	
27	Export_Performance	Q27	-	Exp_Profit_2012	
28	Export_Performance	Q28	-	Exp_Profit_2012_Increase	
29	Gen_Characteristics_Company	Q29	-	Sales_N_Mrkt_Employees_Exports	
30	Additional_Comments	Q30	-	Comments	

Appendix E.   PHASE 2, MODEL VARIABLES FOR ASIA

Table 5.1 Export Performance Model for Asia: Explanatory Variables, Product/Service Characteristics (Factor A)

Question	Factor	Variable	Description
11	Product / Service	X_{11_1}	Product Quality
11	Product / Service	X_{11_2}	Package Quality
11	Product / Service	X_{11_3}	Product Delivery
11	Product / Service	X_{11_4}	On-time Delivery
11	Product / Service	X_{11_5}	Customer Service
11	Product / Service	X_{11_6}	Certified Products
11	Product / Service	X_{11_7}	Volume Availability
11	Product / Service	X_{11_8}	Species Availability
11	Product / Service	X_{11_9}	Custom Planing
11	Product / Service	X_{11_10}	End-coating
11	Product / Service	X_{11_11}	Custom Packaging
11	Product / Service	X_{11_12}	End-trimming
11	Product / Service	X_{11_13}	Pre-surfacing
11	Product / Service	X_{11_14}	Custom Grading
11	Product / Service	X_{11_15}	Dimension Parts
11	Product / Service	X_{11_16}	Color Sorting

Table 5.2 Export Performance Model for Asia: Explanatory Variables, Socio-cultural Characteristics (Factor B)

Question	Factor	Variable	Description
12	Socio-cultural	X_{12_1}	Customs and traditions
12	Socio-cultural	X_{12_2}	Religion
12	Socio-cultural	X_{12_3}	Education level
12	Socio-cultural	X_{12_4}	Values, beliefs, attitudes
12	Socio-cultural	X_{12_5}	Business ethics
12	Socio-cultural	X_{12_6}	Language

Table 5.3 Export Performance Model for Asia: Explanatory Variables, Political-regulatory Characteristics (Factor C)

Question	Factor	Variable	Description
13	Political-regulatory	X_{13_1}	Political stability
13	Political-regulatory	X_{13_2}	Political System
13	Political-regulatory	X_{13_3}	Regulatory System
13	Political-regulatory	X_{13_4}	Gov. attitude foreign Business
13	Political-regulatory	X_{13_5}	Gov. controls/protectionism
13	Political-regulatory	X_{13_6}	Bureaucracy
13	Political-regulatory	X_{13_7}	Business Protection
13	Political-regulatory	X_{13_8}	International Association
13	Political-regulatory	X_{13_9}	Gov. Foreign Policies

Table 5.4 Export Performance Model: Response Variables

Question	Factor	Variable	Description
26	Socio-cultural	Y_1	Export Sales
27	Socio-cultural	Y_2	Export Sales Growth
28	Socio-cultural	Y_3	Export Profit
29	Socio-cultural	Y_4	Export Profit Growth

Appendix F.   PHASE 2, MODEL VARIABLES FOR EUROPE

Table 5.5 Export Performance Model for Europe: Explanatory Variables, Product/Service Characteristics (Factor A)

Question	Factor	Variable	Description
41	Product / Service	X_{41_1}	Product Quality
41	Product / Service	X_{41_2}	Package Quality
41	Product / Service	X_{41_3}	Product Delivery
41	Product / Service	X_{41_4}	On-time Delivery
41	Product / Service	X_{41_5}	Customer Service
41	Product / Service	X_{41_6}	Certified Products
41	Product / Service	X_{41_7}	Volume Availability
41	Product / Service	X_{41_8}	Species Availability
41	Product / Service	X_{41_9}	Custom Planing
41	Product / Service	X_{41_10}	End-coating
41	Product / Service	X_{41_41}	Custom Packaging
41	Product / Service	X_{41_12}	End-trimming
41	Product / Service	X_{41_13}	Pre-surfacing
41	Product / Service	X_{41_14}	Custom Grading
41	Product / Service	X_{41_15}	Dimension Parts
41	Product / Service	X_{41_16}	Color Sorting

Table 5.6 Export Performance Model for Europe: Explanatory Variables, Socio-cultural Characteristics (Factor B)

Question	Factor	Variable	Description
42	Socio-cultural	X_{42_1}	Customs and traditions
42	Socio-cultural	X_{42_2}	Religion
42	Socio-cultural	X_{42_3}	Education level
42	Socio-cultural	X_{42_4}	Values, beliefs, attitudes
42	Socio-cultural	X_{42_5}	Business ethics
42	Socio-cultural	X_{42_6}	Language

Table 5.7 Export Performance Model for Europe: Explanatory Variables, Political-regulatory Characteristics (Factor C)

Question	Factor	Variable	Description
43	Political-regulatory	X_{43_1}	Political stability
43	Political-regulatory	X_{43_2}	Political System
43	Political-regulatory	X_{43_3}	Regulatory System
43	Political-regulatory	X_{43_4}	Gov. attitude foreign Business
43	Political-regulatory	X_{43_5}	Gov. controls/protectionism
43	Political-regulatory	X_{43_6}	Bureaucracy
43	Political-regulatory	X_{43_7}	Business Protection
43	Political-regulatory	X_{43_8}	International Association
43	Political-regulatory	X_{43_9}	Gov. Foreign Policies

Appendix G. PHASE 2P-VALUES FOR INDEPENDENCE TESTS (FISHER'S)

Table 5.8 *P*-values for independence tests (Fisher's): Asian Markets

Factor	Variable	Description	Response			
			Q26	Q27	Q28	Q29
			Sales 2012	Growth 2012	Profit 2012	Growth 2012
	Q11_1	Product Quality	1.0000	0.6571	1.000	0.1429
	Q11_2	Package Quality	1.0000	0.7425	0.2857	0.6000
	Q11_3	Product Delivery	0.8857	1.0000	0.2857	0.4857
	Q11_4	On-time Delivery	0.8857	1.0000	0.5714	1.0000
	Q11_5	Customer Service	0.8857	1.0000	0.5714	0.4857
	Q11_6	Certified Products	0.8857	1.0000	1.0000	1.0000
	Q11_7	Volume Availability	0.8857	0.5143	1.0000	0.0857
A	Q11_8	Species Availability	0.8000	0.7000	1.0000	1.0000
	Q11_9	Custom Planing	0.3143	1.0000	0.2857	1.0000
	Q11_10	End-coating	0.7714	1.0000	0.3330	1.0000
	Q11_11	Custom Packaging	0.5429	1.0000	0.1429	0.7714
	Q11_12	End-trimming	0.8857	1.0000	0.5714	1.0000
	Q11_13	Pre-surfacing	1.0000	0.5143	0.5714	1.0000
	Q11_14	Custom Grading	1.0000	1.0000	0.4762	1.0000
	Q11_15	Dimension Parts	0.7714	0.4286	0.4286	0.3524
	Q11_16	Color Sorting	0.8857	0.5143	1.0000	1.0000
	Q12_1	Customs and traditions	0.5810	1.0000	0.8095	1.0000
	Q12_2	Religion	1.0000	0.8571	0.5238	1.0000
B	Q12_3	Education level	0.2000	1.0000	0.1667	1.0000
	Q12_4	Values, beliefs, attitudes	0.8857	1.0000	0.5714	1.0000
	Q12_5	Business ethics	0.6571	1.0000	1.0000	0.7714
	Q12_6	Language	0.3143	1.0000	1.0000	1.0000
	Q13_1	Political stability	0.1667	1.000	1.000	1.000
	Q13_2	Political System	1.000	1.000	0.8085	1.000
	Q13_3	Regulatory System	0.8857	1.000	0.2857	1.000
	Q13_4	Gov. attitude foreign Business	0.4286	0.7714	1.000	0.7714
C	Q13_5	Gov. controls/protectionism	0.3333	0.8571	1.000	0.4286
	Q13_6	Bureaucracy	0.2000	1.000	1.000	1.000
	Q13_7	Business Protection	0.1143	0.5143	1.000	0.4857
	Q13_8	International Association	0.7143	0.8571	0.5238	1.000
	Q13_9	Gov. Foreign Policies	0.1143	0.5143	1.000	0.4857

Table 5.9 *P*-values for independence tests (Fisher's): European Markets

Factor	Variable	Description	Response			
			Q26	Q27	Q28	Q29
			Sales 2012	Growth 2012	Profit 2012	Growth 2012
A	Q41_1	Product Quality	1.0000	1.0000	0.1667	0.0667
	Q41_2	Package Quality	0.2000	1.0000	1.0000	0.7333
	Q41_3	Product Delivery	1.0000	1.0000	0.6667	0.1333
	Q41_4	On-time Delivery	1.0000	1.0000	0.6667	0.1333
	Q41_5	Customer Service	1.0000	1.0000	0.3333	0.2444
	Q41_6	Certified Products	1.0000	1.0000	1.0000	1.0000
	Q41_7	Volume Availability	0.4667	1.0000	1.0000	0.2444
	Q41_8	Species Availability	0.7000	0.2000	1.0000	1.0000
	Q41_9	Custom Planing	0.2000	1.0000	0.5000	1.0000
	Q41_10	End-coating	1.0000	1.0000	0.3333	1.0000
	Q41_11	Custom Packaging	0.7000	0.0167	0.5000	0.4000
	Q41_12	End-trimming	0.2000	1.0000	1.0000	1.0000
	Q41_13	Pre-surfacing	0.6000	1.0000	1.0000	1.0000
	Q41_14	Custom Grading	0.7000	1.0000	0.5000	1.0000
	Q41_15	Dimension Parts	0.4667	1.0000	1.0000	1.0000
	Q41_16	Color Sorting	0.8000	0.2667	0.5000	1.0000
B	Q42_1	Customs and traditions	0.8000	1.0000	0.1667	1.0000
	Q42_2	Religion	0.1667	1.0000	1.0000	1.0000
	Q42_3	Education level	1.0000	1.0000	1.0000	1.0000
	Q42_4	Values, beliefs, attitudes	1.0000	1.0000	0.3333	0.0667
	Q42_5	Business ethics	0.2000	1.0000	0.5000	1.0000
	Q42_6	Language	0.8000	1.0000	0.5000	0.4667
C	Q43_1	Political stability	0.4000	1.0000	1.0000	0.7333
	Q43_2	Political System	0.8000	1.0000	1.0000	0.4667
	Q43_3	Regulatory System	0.7000	1.0000	0.5000	0.4000
	Q43_4	Gov. attitude foreign Business	1.0000	1.0000	0.5000	0.4667
	Q43_5	Gov. controls/protectionism	0.8000	1.0000	1.0000	1.0000
	Q43_6	Bureaucracy	0.0500	1.0000	1.0000	1.0000
	Q43_7	Business Protection	0.4667	1.0000	1.0000	1.0000
	Q43_8	International Association	0.2667	1.0000	1.0000	1.0000
	Q43_9	Gov. Foreign Policies	1.0000	1.0000	0.3333	0.0222

Appendix H. PHASE 2, PARAMETER ESTIMATES AND P-VALUES FOR LOGISTIC REGRESSION

Table 5.10 Parameter Estimates and P-values for Logistic Regression: Asian Markets

Factor	Explanatory Variable	Analysis Of Maximum Likelihood Parameter Estimates							
		Q26		Q27		Q28		Q29	
		Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
A	Q11_1	2.00	0.0143	-2.00	0.0047	1.00	0.1573	-2.00	0.0047
	Q11_2	-1.08	0.1162	1.25	0.1909	0.17	0.8615	2.08	0.0292
	Q11_3	-0.08	0.8055	-0.75	0.6350	-1.83	0.2459	0.08	0.9579
	Q11_4	.	.	.	.	.	.	.	.
	Q11_5	.	.	2.00	0.4733	1.67	0.5501	-0.67	0.8111
	Q11_6	.	.	-0.50	0.4733	-0.33	0.6326	-0.17	0.8111
	Q11_7	.	.	.	.	.	.	.	.
	Q11_8	-1.67	0.0477	.	.	.	.	.	.
	Q11_9	.	.	.	.	.	.	.	.
	Q11_10	.	.	.	.	.	.	.	.
	Q11_11	.	.	.	.	.	.	.	.
	Q11_12	.	.	.	.	.	.	.	.
	Q11_13	.	.	.	.	.	.	.	.
	Q11_14	.	.	.	.	.	.	.	.
	Q11_15	.	.	.	.	.	.	.	.
	Q11_16	.	.	.	.	.	.	.	.
B	Q12_1	-2.75	0.0300	3.75	0.0030	-0.50	0.6949	3.25	0.0100
	Q12_2	6.25	0.0300	-10.25	0.0030	-0.50	0.8608	-10.75	0.0002
	Q12_3	3.50	0.0300	-4.50	0.0040	0.40	0.5271	-5.50	0.0005
	Q12_4	-0.25	0.7500	-0.25	0.7510	0.40	0.5271	2.75	0.0005
	Q12_5	3.25	0.0200	-1.25	0.3910	0.12	0.7316	-3.75	0.0100
	Q12_6	.	.	.	.	.	.	.	.
C	Q13_1	1.00	0.7556	2.00	0.5164	-5.50	0.0744	.	.
	Q13_2	-1.00	0.4142	4.00	**0.0011**	-1.50	0.2207	4.00	**0.0011**
	Q13_3	2.00	0.4342	-8.00	**0.0017**	3.50	0.1698	-8.00	**0.0017**
	Q13_4	-1.00	0.4795	1.00	0.4795	-2.00	0.1573	-1.00	0.4795
	Q13_5	1.00	0.6374	1.00	0.6374	3.50	0.0990	3.00	0.1573
	Q13_6	.	.	.	.	.	.	.	.
	Q13_7	.	.	.	.	.	.	.	.
	Q13_8	.	.	.	.	.	.	.	.
	Q13_9	.	.	.	.	.	.	.	.

Table 5.11 Parameter Estimates and P-values for Logistic Regression: European Markets

Factor	Explanatory Variable	Analysis Of Maximum Likelihood Parameter Estimates							
		Q26		Q27		Q28		Q29	
		Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value	Estimate	*p*-value
A	Q41_1	-1.43	0.1317	1.00	0.2913	-0.57	0.5465	1.57	0.0973
	Q41_2	4.79	0.0565	-1.00	0.6902	0.71	0.7759	-1.71	0.4945
	Q41_3	-2.82	0.0633	3.50	0.0213	-0.43	0.7779	3.43	0.0240
	Q41_4	2.96	0.0325	-3.50	0.0116	0.29	0.8367	-4.29	0.0020
	Q41_5	.	.	.	.	.	.	.	.
	Q41_6	-0.25	0.4795	-0.50	0.1573	0.00	1.0000	0.00	1.0000
	Q41_7	.	.	.	.	.	.	.	.
	Q41_8	.	.	.	.	.	.	.	.
	Q41_9	.	.	.	.	.	.	.	.
	Q41_10	.	.	.	.	.	.	.	.
	Q41_11	.	.	.	.	.	.	.	.
	Q41_12	.	.	.	.	.	.	.	.
	Q41_13	.	.	.	.	.	.	.	.
	Q41_14	.	.	.	.	.	.	.	.
	Q41_15	.	.	.	.	.	.	.	.
	Q41_16	.	.	.	.	.	.	.	.
B	Q42_1	0.00	1.0000	0.00	1.0000	-1.00	0.6171	-6.00	0.0027
	Q42_2	2.50	0.1138	-4.50	0.0044	0.00	1.0000	-1.50	0.3428
	Q42_3	0.50	0.8445	3.50	0.1698	-1.00	0.6949	-5.50	0.031
	Q42_4	-0.50	0.8828	-0.50	0.8828	1.00	0.7681	10.50	0.002
	Q42_5	-0.50	0.4795	1.50	0.0339	.	1.0000	0.50	0.4795
	Q42_6	.	.	.	.	.	.	.	.
C	Q43_1	0.50	0.7681	4.50	0.008	0.50	0.7681	6.00	0.0004
	Q43_2	2.00	0.1025	-5.00	<.0001	0.00	1.0000	-6.00	<.0001
	Q43_3	0.50	0.4142	-0.50	0.4142	-0.50	0.4142	-1.00	0.1025
	Q43_4	-1.00	0.4142	4.00	0.0011	0.00	1.0000	1.00	0.4142
	Q43_5	-1.00	0.4795	-2.00	0.1573	0.00	1.0000	6.00	1.0000
	Q43_6	.	.	.	.	.	.	.	.
	Q43_7	.	.	.	.	.	.	.	.
	Q43_8	.	.	.	.	.	.	.	.
	Q43_9	.	.	.	.	.	.	.	.